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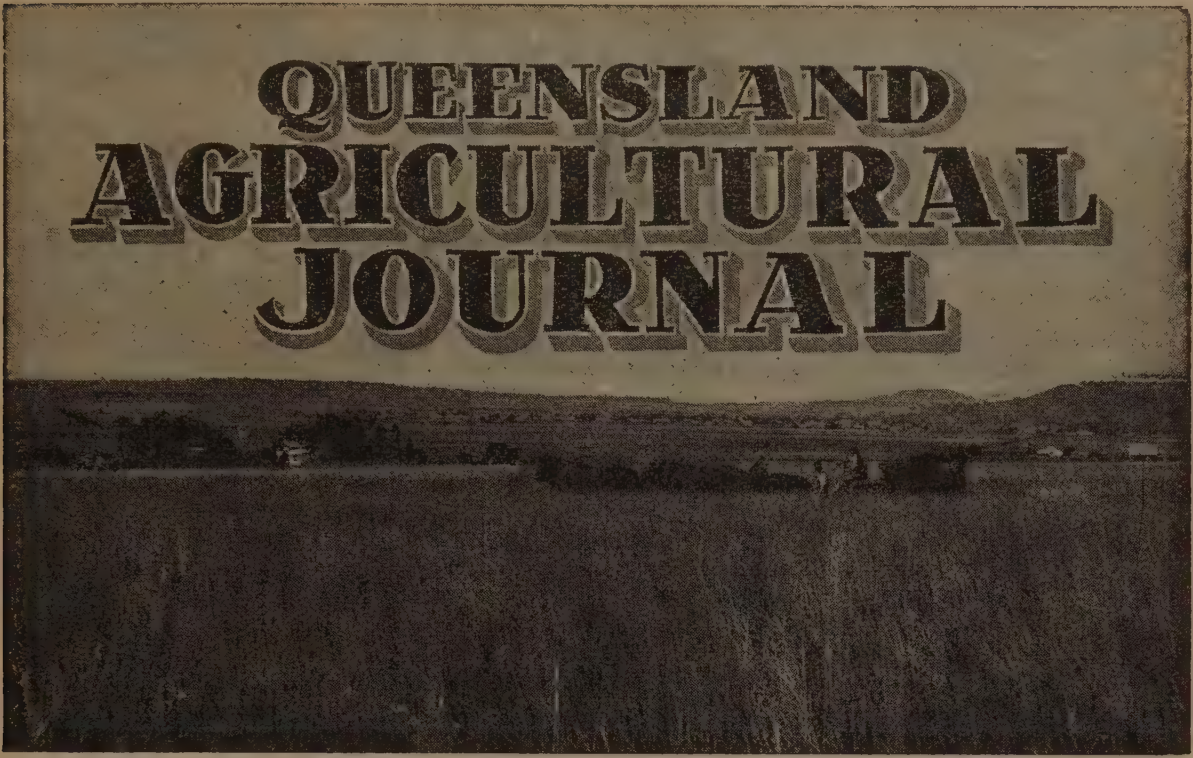

VOL. XLVII. 1 JANUARY, 1937. PART 7

Event and Comment

Protection for Primary Producers.

THE Commonwealth Government proposes to take a referendum on 6th March on the subject of an addition to section 92 of the Commonwealth Constitution. Two questions naturally arise:—

(1) Why did the fathers of Federation draft section 92—the cause of the farmer's present difficulty—and adopt it in its present form? (2) Why, after thirty-six years of Federation, has it now become evident that this section of the Constitution has, to say the least of it, outlived its usefulness?

So far as can be understood, portion of section 92 was adopted as a compromise when all men's minds were concentrated on tariff policies. The section was deliberately inserted to prevent the different States of the Federation from adopting tariff policies which, while advantageous to them, would have been disadvantageous to other States within the Federation.

Discussing this matter recently, the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, said—

> "In those far-off days there was no suggestion of the organisation of primary producers. In fact, the farmer had so long been the victim of economic forces that nobody even suspected that the time would come when the producer would put concrete proposals for his economic security before Parliaments and cause them to be carried into effect.
>
> "It might reasonably be argued that the arbitration tribunals provided by the States and Commonwealth for wage-earners should have their counterparts for the agriculturist. As arbitration conditions obviously could not apply to the farmer, it became necessary to introduce legislation which gave the farmer some control over the disposal of his produce.
>
> "The real intention behind this legislation was to enable the farmer to gain a fairer economic price for his commodities, and the national viewpoint was that the expansion of Australia must be largely agricultural, and that our expansion could take place only when based on a recognition of the claims of the producer for social and economic justice.
>
> "Queensland was the first State of the Commonwealth to recognise these domestic and national equations, and as a result many years ago several pool boards under grower control were established, and it is safe to say that to-day the farmer does not desire, nor can he afford to go back to the old principles of exploitation, to which he was a victim in the years that are gone. The pool boards in Queensland succeeded in establishing a fair economic price for the producer. In fact, they translated into concrete terms that biblical axiom—'The labourer is worthy of his hire.' "

A successful movement of this description naturally attracted attention to Queensland, and after representations the Commonwealth Government entered into the field of organisation. The Federal Government relied on its powers under section 92, which it was believed at that time bound the States but did not bind the Commonwealth. By a series of legislative enactments several main branches of agriculture were able to organise on a Commonwealth plane, and by a combination of authority the State and Federal Governments were able to regulate interstate trade and set up domestic parities.

The position then was, or appeared to be, that the State had full control of domestic trade; the Commonwealth had the power to regulate interstate trade and to fully control export trade.

Then came the James judgment, in which the Privy Council said: "The State has full power to control domestic trade; the Commonwealth has full power to control export trade, but neither the State nor the Commonwealth has any power to regulate or to control interstate trade." As legislation cannot override the Constitution, the position then became grave in so far as Commonwealth-wide organisations functioning under legislation were declared by virtue of the James judgment to be operating on authority possessing no legal sanction.

The Coming Referendum on Commonwealth Marketing.

REFERRING to the referendum to be taken throughout Australia in March next, Mr. Bulcock stated that the people would be simply asked to give back to the Commonwealth the powers the High Court of Australia believed the Commonwealth was possessed of and which it operated for a number of years. He added:—

> "There are many reasons why this submission should be approved, and perhaps the greatest is that all permanence in society is based on justice. As the farmer is compelled to purchase his commodities in a protected market, and as he has made very large contributions to the solvency of Australia, more particularly during the difficult period of depression, it is obviously fair that he should have extended to him, in whatever form may be practicable, the protection that the people of Australia have given to manufacturers, wage earners, and others.
>
> "As the Constitution has proved itself incapable of adjusting itself to the changing conditions of national life and to the new conceptions of agricultural and commercial practices, a readjustment is imperative, for the farmer cannot survive on overseas parity, which he cannot control, and which frequently reacts against him."

For instance, recently there was a rapid decline in the overseas price of butter. This lessened earning power on the British market was in no way related to the cost of production in Australia. In fact, the production costs of butter were greater during the decline than ordinarily, owing to drought conditions. It represents a phase of marketing over which the producer has no control, and which is frequently harsh in its incidence.

These things were recognised nearly three years ago by Governments, when the Butter Stabilisation Scheme came into operation, and even before that the principle of domestic parity was recognised in respect to the Paterson Scheme, which stabilised butter prices to a degree, and also the Dried Fruits Acts, which was some years ago the subject-matter of an appeal to the Privy Council.

To argue that the farmer must rely on overseas parity, which ordinarily determines domestic price, is to assert that the standard of living of the farmer shall be the standard of living in the countries that determine the price in, say, London, or, in other words, that there will be a lowering of the Australian standard of living which shall be applied to one of the classes—the farming class. This, of course, would be obviously unfair, more particularly in view of the fact that, had it not been for the export of primary products during the last ten years, Australia would have been hopelessly insolvent, and would have gone through the grave financial crises that were so sadly in evidence in many countries of the world.

The Minister's New Year Message

WITH the dawn of the New Year, the farming communities are facing a poll of far-reaching importance to primary production throughout the Commonwealth. If the referendum is carried, producers may look forward to further advances in their economic position. As this question is likely to be the most important to be raised this year, and as important consequences for good or evil will follow the decision, I urge the farming community to close their ranks and make every effort to secure the much to be desired "yes" vote.

The year which has just closed has been one of tribulation and hardship for many sections of producers. Drought and disease have sown grim havoc over many of our landscapes, but the courage of our farmers remains undaunted, and all eyes are turned towards the dawn of happier days. I earnestly pray that these hopes will be realised and life on the land made more profitable from every point of view.

We cannot remain unmindful of the lessons of the past year, but must face the problems to which they may be applied in a spirit of resolute endeavour to overcome the difficulties with which our agriculture is faced, in common with that of every other country.

The coming year should see the introduction of a Federal system of marketing control and, in the State sphere, the launching of a too long-delayed scheme for water and fodder conservation.

At this time we remember the women of the bush and their loyalty to their men and their homes and their fortitude in the face of adversity, and especially hope that to them the New Year will bring its due rewards.

On behalf of the Officers of the Department of Agriculture and Stock, and on my own behalf, I sincerely wish our friends on the land in every part of Queensland a happy, contented, and prosperous New Year.

Frank. W. Bulcock

Seed Treatment of Maize.

R. B. MORWOOD, M.Sc., Pathologist, Department of Agriculture and Stock, and W. W. BRYAN, M.Sc.Agr., Instructor in Plant Breeding, Queensland Agricultural High School and College.

A SERIES of experiments designed to test the effect of a mercurial seed dressing on the yield of maize has been carried out at the Queensland Agricultural High School and College, the Departments of Public Instruction and of Agriculture and Stock co-operating. The series was the outcome of a previous experiment ("Queensland Agricultural Journal," XXXVIII. p. 22) in which the possibility of an increase was indicated. In the early experiment seed slightly affected with dry rot (*Diplodia zeæ*) had been used, but it was suspected at the time that the effect of the treatment was due to stimulation rather than to actual control of disease. Further consideration of the problem in the light of the results now obtained with disease free seed would indicate that any increase was due to some disease control factor such as a lessening of the incidence of root rot associated with lightly affected seed.

In the experiments which form the subject of this report carefully selected clean seed was used throughout. A late variety—Fitzroy or Improved Yellow Dent—and a mid-season variety—Golden Superb—were included in the trials as were three different dusts tillantin R., ceresan, and semesan. Other dusts which have been favourably reported upon in America are not available locally.

An apparent definite increase in the yield following treatment with tillantin R. in the first year of the trials could not be substantiated in the subsequent more elaborate experiments. In the following season the crop failed and no results were obtained. In the 1934-35 and 1935-36 seasons extensive and carefully planned trials failed to show any advantage for ceresan and tillantin R. dust treatment of healthy seed. Slight increases in favour of treated seed in the former season were not maintained in the latter when with one variety of maize the untreated plots yielded significantly higher than the treated. In 1934-35 the plots planted with seed treated with the dust semesan had a higher average yield than the untreated and the result was just significant. The results with semesan were, however, little if at all better than those with ceresan, and in view of the generally conflicting results in different seasons little notice can be taken of such an isolated increase.

Results.

Yields for 1932-33 and 1934-35 are at 14 per cent. moisture content. In 1935-36 air-dried weights were taken. Row spacing throughout was 4 feet 6 inches.

Season 1931-32.—Trial lost through drought.

Season 1932-33.—

Plan: Four Beaven half-drill strips.

Plot size: Ten rows, 1 chain long, reduced at harvest to 8 rows, 18 yards long. Sown in hills 3 feet apart, 5 seeds sown, each hill thinned to 3 plants.

Planting date: 23rd November, 1932.

Rainfall: 1,742 points over growing period.

Variety: Fitzroy (late).

Treatment.	Bushels per Acre.	Significantly Exceeds.
1. Tillantin R.	56·75	2
2. Untreated	47·95	..

(Odds are > 200·1 in favour of a difference.
S.E. (single plot) = 1·98 b.p.a. Significant difference = 2·80 b.p.a.)

Season 1933-34.—Trial lost through drought.

Season 1934-35.—

Plan: Four 4 x 4 latin squares. (Two independently randomised squares for each variety.)

Plot size: Six rows, 1 chain long, reduced at harvest to 4 rows, 18 yards long. Sown in hills, as in 1932-33.

Planting date: 26th November, 1934.

Rainfall: 1,731 points over growing period.

Varieties: Improved Yellow Dent (late), Golden Superb (mid-season).

Treatment. (Golden Superb.)	Bushels per Acre.	Significantly Exceeds.
1. Semesan	35·53	..
2. Ceresan	34·72	..
3. Tillantin R.	34·02	..
4. Untreated	31·65	..

(Fisher's "Z" test showed that the differences were not significant.)

Treatment. (Improved Yellow Dent.)	Bushels. per Acre.	Significantly Exceeds.
1. Ceresan	31·01	..
2. Semesan	30·66	..
3. Untreated	30·52	..
4. Tillantin R.	29·56	..

(Fisher's "Z" test showed that the differences were not significant.)

Treatment. (Both Varieties.)	Bushels per Acre.	Significantly Exceeds.
1. Semesan	33·09	Untreated
2. Ceresan	32·86	..
3. Tillantin R.	31·79	..
4. Untreated	31·08	..

(S.E. (single plot) = 2·4 b.p.a.
Significant difference = 1·82 b.p.a.)

NOTE.—In this trial (1934-35) mature plant counts were made just prior to harvest. No significant differences in stand could be demonstrated and analyses of covariance for stand and yield showed that in neither variety was there any justification for adjusting yields on the basis of observed differences in stand.

Season 1935-36.—

Plan: Forty-two randomised blocks. (Twenty-one for each variety.)

Plot size: A single row, 86 feet long ($\frac{1}{10}$ acre approximately). Single seeds were spaced one foot apart in the row.

Planting date: 6th December, 1935.

Rainfall: 1,468 points over growing period.

Varieties: Improved Yellow Dent (late), Golden Superb (mid-season).

Row weights were adjusted for stand differences on the basis of a correlation of approximately 0.7 between stand and yield.

Treatment. (Golden Superb.)	Bushels per Acre.	Significantly Exceeds.
1. Untreated	31·26	2 and 3
2. Ceresan	28·23	3
3. Tillantin R.	25·87	..

(S.E. (single plot) = 3·26 b.p.a.

Significant difference = 2·18 b.p.a.)

Treatment. (Improved Yellow Dent.)	Bushels per Acre.	Significantly Exceeds.
1. Ceresan	25·22	..
2. Tillantin R.	24·10	..
3. Untreated	23·51	..

(Fisher's "Z" test showed that no differences were significant.)

Treatment. (Both Varieties.)	Bushels per Acre	Significantly Exceeds.
1. Untreated	27·29	..
2. Ceresan	26·69	..
3. Tillantin R.	24·96	..

(Fisher's "Z" test showed that no differences were significant.)

Conclusion.

The experiments warrant no recommendation for the treatment of well selected maize seed for sowing in Southern Queensland.

◆

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Studies on the Biology and Control of the Large Roundworm of Fowls, Ascaridia galli (Schrank 1788) Freeborn 1923.

F. S. H. ROBERTS, D.Sc., Animal Health Station, Yeerongpilly.

[*Continued from p. 746, Part VI., Vol. XLVI.—December*, 1936.]

PART VII.

II. PROPHYLAXIS.

The control of any parasitic disease cannot be brought to a very high standard of efficiency, unless measures are enforced which will prevent infestation by the parasites concerned, or will at least maintain their numbers below the numerical point at which the parasites become harmful.

As there are indications, as set out by Thomas[100], for example, that the treatment of poultry for helminths may not in all cases give beneficial results, the application of any measures which will prevent infestation becomes a very important factor in any worm control campaign associated with domestic birds.

In general, poultry are housed under either one of two systems of farm management, the intensive system or the free-range system. In the light of the knowledge which has been gained in this present investigation, the intensive system, both from the theoretical and practical standpoints, appears to lend itself more readily to helminth control than the free-range system. As the egg becomes infective in the minimum period of eight days, all that appears necessary, therefore, for the control of *A. galli,* where the housing is intensive, is the removal of the droppings at regular intervals of at least seven days. The floors in the houses must necessarily be of concrete or wood, which would permit a thorough removal of all fæcal matter.

As evidence of the degree of control which may be obtained through the adoption of this system some observations by Cuvillier and Jones[45] are of interest. These workers examined three groups of birds—(*a*) Group 1, which had been raised on concrete floors, and when adults confined to buildings with wooden floors; (*b*) Group 2, which had been raised on free range, and when adults confined as in Group 1 and (*c*) Group 3, which had been kept on free range throughout life. Comparing the worm burdens of each group it was found that 30 out of 40 birds were entirely free from worms in Group 1, whilst in Group 2 only two out of 40 birds, and in Group 3 only one out of 36 birds contained no worms.

Besides the removal of droppings at regular seven-day intervals, other measures which are considered to be of value in preventing infestation would be:—

1. Incubators should be given a thorough cleansing before use, and a boiling 5 per cent. disinfectant solution applied. All eggs should be carefully washed.

2. The young chicks should be confined in special brooder pens. These pens should be retained solely for the use of chicks. Concrete or wooden floors are desirable, concrete for preference, and these could be previously cleansed by the liberal application of a boiling 5 per cent. disinfectant solution.

Where it is found too expensive to put in floors of concrete or wood, brooder pens should be placed on soil on which poultry have never been present or have not been running for a number of years.

3. Special precautions should be taken with young birds till they are about three to four months old. For example, the use of a pair of goloshes slipped over the boots when entering a pen of young birds and retained solely for that purpose would be very desirable.

4. Food should be fed as far as practicable from hoppers. Drinking vessels should be of such a type as do not permit the surrounding soil being maintained in a state of constant dampness.

5. It would be advisable to give attention to all damp places in the yards, especially those in shaded positions. The yards and buildings should be kept clean and tidy.

6. Overstocking with the free range and semi-intensive systems is to be avoided. In the case of such animals as sheep, the rate of stocking depends largely on the available food. With poultry, on the other hand, the optimum number of birds per unit area is determined by the health of the birds and their productivity, and can be ascertained only by experience.

7. Rotation of runs and yards is advisable. Where possible yards, etc., should lie spelled from poultry for periods of at least one year.

8. Finally, the greatest consideration should be given to the ration employed. This should be well balanced, with adequate quantities of vitamins A and B and of animal protein. The closest attention should also be given to any other measures which would assist towards maintaining the birds in a good state of health.

Acknowledgments.

This investigation was largely dependent upon the financial assistance given by the Poultry Advisory Committee, Brisbane, to which the writer is duly grateful. Acknowledgment must also be made to Mr. J. Ladewig, late Experimentalist to this Station, for rearing the chickens used in the investigation; to Dr. H. R. Carne, McMaster Laboratory, Sydney, for his kindness in interpreting the histo-pathology of the experimental infestations; to Miss H. Newton Turner, Biometrician, McMaster Laboratory, and Mr. P. McGovern, of this Department, for the statistical analyses; to Mr. I. W. Helmsing, Illustrator, Entomological Branch, for the excellent illustrations and photomicrographs; and to the Poultry Branch of this Department for the assistance given by its officers at various times.

Summary.

1. An investigation has been made into the biology and control of the large roundworm of fowls, *Ascaridia galli.*

2. An examination of 579 birds from the Brisbane area showed the species to be present in 42·1 per cent.

3. A description of the fertile and infertile egg is given. The only other helminth egg with which the egg of *A. galli* could be confused in fæcal examinations of birds in Queensland is that of the cæcum worm, *Heterakis gallinæ.* Distinguishing features of the eggs of these two species are discussed.

4. The optimum temperature for egg development is 33°C. Fresh eggs may withstand temperatures as low as —7·5°C to —3°C for about seventeen days. Temperatures higher than 33°C. are eventually fatal.

5. Fresh and embryonated infectious eggs exposed to sunlight in a liquid medium did not survive for periods longer than three hours. When associated with conditions of desiccation no eggs survived exposure to sunlight for longer than two hours. Eggs in fresh normal-sized droppings allowed to dry out were killed in sunlight after fourteen days, whilst the presence of moisture increased their longevity to twenty-eight days.

6. Fresh and embryonated infectious eggs dried out on glass slides in the shade survived twenty-five, but not thirty, days. Eggs in fresh, normal-sized droppings allowed to dry out in the shade lived thirty-seven days.

7. The resistance of the egg to chemicals of possible use as ovicides was investigated. As a result of these trials it is recommended that a boiling 5 per cent. aqueous solution of a disinfectant with a relatively high tar-acid content be employed.

8. Studies on the longevity of the egg under laboratory conditions showed that in a tap water medium eggs may survive 368 days. Eggs in droppings exposed to natural conditions of rainfall, etc., survived 249 days in a shaded position and 103 days in a position constantly exposed to sunlight.

9. Studies on the life history of *A. galli* showed that under optimum conditions for development the egg may become infective in eight days. The infective stage is the second stage larva, the first moult occurring in the egg in about seven days.

Such infective eggs when fed to chicks hatch in the small intestine, the young larvæ being most frequent a few centimetres posterior to the entrance of the bile duct. For the first nine days the larvæ live freely in the lumen. From the tenth to the nineteenth day the larvæ attack the intestine tissues, and in general feed upon the epithelium lining the crypts. A few larvæ, however, may burrow more deeply into the tissues, and in rare instances may completely penetrate the bowel wall to subsequently occur in the liver, lungs, etc. After the nineteenth day, the larvæ again live freely in the lumen.

Three moults occur during the parasitic life cycle, five, twelve, and eighteen days respectively after infestation. The minimum maturity period observed was twenty-seven days.

10. Observations in the field, assisted by experiments in which birds were fed single and continuous doses of infectious eggs, have demonstrated that *A. galli* is a pathogenic helminth. The symptoms and lesions associated with infestation are described.

11. The resistance of the fowl to infestation was investigated, and it was found that under experimental conditions an age resistance and an acquired resistance could be demonstrated. Among old birds there is both a resistance to the worm itself and to its effects.

Age resistance experiments indicated that if birds could be reared under worm-free conditions till about four months of age they could then be turned on to infested soil with little subsequent ill-effects.

By virtue of this age resistance and assisted by a resistance developed as a result of continuous exposure to infestation old birds should therefore remain unaffected. An attempt to explain why this is not so under natural conditions, as based on Foster's work with *Ancylostoma caninum* in dogs and on Ackert's and Herrick's work on the effect of diet and repeated bleeding on the resistance of the fowl to infestation with *A. galli,* is that any condition likely to affect the health of the fowl makes it susceptible to infestation.

12. Both individual treatment and flock treatment trials were carried out.

Individual Treatment.—A series of tests with several drugs on young birds experimentally infested indicated that a very high efficiency could be secured with carbontetrachloride. Tests with this drug on naturally-infested adult birds confirmed these results. The effective dose rate is given as ·75 ml. per pound weight to a maximum dose of 2 ml., which dose rate is regarded as being reasonably safe. Starvation overnight is necessary for high efficiencies, but no after-starvation period is required. For the purposes of economy it is recommended that the drug be given by means of a syringe and rubber tubing, though higher efficiencies were secured in the young birds by the administration of the drug in capsules.

Two field trials with this drug were carried out on three-year-old birds over a period of eleven to thirteen weeks, and three treatments each of 2 ml. carbontetrachloride were given with an interval of three weeks between each treatment. Unfortunately no evidence of the existence of a heavy infestation in the birds used in either trial was obtained. Under the conditions of the experiments, however, it was found (1) that the handling and starvation associated with treatment did not affect production; (2) that treated lightly infested White Leghorn hens did not at any time reach the production of the untreated birds. The food consumption of the treated birds was also less; (3) in Australorps, in which the infestation was unknown, production was greater in the treated birds than in the controls. The treated birds, moreover, required less food to produce a dozen eggs; (4) treatment was effective against *Ascaridia galli.*

It was concluded that the drug as used in these experiments was not tolerated by the White Leghorns to the same degree as by the heavier Australorps.

Flock Treatment.—Nicotine sulphate mixed with the mash at the rate of ·5 ml. in 150 ml. water per pound of mash, and fed for a period of seven days proved very effective (82·5 per cent.) against *A. galli* under laboratory conditions. This mixture also gave an efficiency of 54.5 per cent. against *H. gallinæ.*

These efficiencies were confirmed by field trials in which four treatments were given at intervals of four weeks over a period of nineteen weeks. The results of these trials also indicated (1) that in the case of lightly infested light breeds treatment may have some toxic effects in so far as can be ascertained by egg production, but with heavily-infested light breeds the removal of the worms by treatment more than offsets any toxicity, so that egg production is increased, the amount of food required to produce a dozen eggs is decreased and the treated birds also convert more food into body weight; and (2) no ill-effects from treatment occurred in a heavy breed, in which the infestation was unknown, treatment resulting in an increased egg production.

Further trials are to be carried out in the field with both carbon-tetrachloride and nicotine sulphate. It would seem that where preventive measures are not enforced control by treatment can be secured only by the regular use of a vermifuge, the interval between treatments being such that the worms do not become large or numerous enough to be pathogenic. For such an experiment birds infested to a degree that their health is impaired are most desirable, otherwise any possible advantage of the removal of the infestation over any toxicity from treatment will not be shown.

13. Measures to prevent infestation are given and the advantages of the intensive system for the application of such measures are discussed.

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VAPOUR TREATMENT EXPERIMENTS FOR THE CONTROL OF BLUE MOULD OF TOBACCO.

Experiments with vapours for the control of blue mould of tobacco in seed-beds were carried out in Brisbane early last year, and have been discussed recently in a report prepared by the Tobacco Pathologist of the Department of Agriculture and Stock.

This method of disease control was developed some twelve months ago by the Council for Scientific and Industrial Research with experiments at Canberra and at various other centres. The most satisfactory results were obtained by evaporating benzol in vapour-tight seed-bed frames at a "normal" concentration, obtained when an area of liquid was exposed equal to 2 square inches for each square foot of seed-bed. In further experiments by the Council and by the agricultural departments of various States other volatile liquids such as toluol, petrol, and the proprietary material, "X3 Solvent," were tested, and in some cases concentrations other than normal were investigated.

In the Brisbane experiments the four materials, benzol, toluol, "X3 Solvent," as well as "X300 Special Boiling Point Spirit," were used at both the "normal" and half the "normal" concentration. In order to compare gas treatment with copper sprays some plots were sprayed with colloidal copper and soft soap. An attempt was also made to reduce the initial cost of equipment by using a special type of vapour-tight tent in place of the more expensive cold-frame for covering the seedlings during vapour treatment.

Although spores of the blue mould fungus were introduced into the seed-beds both by artificial and natural means, the gas-treated beds were successfully protected from the disease, and untreated plants contracted blue mould. This result was obtained with the four volatile liquids tested when used at both "normal" and half "normal" concentrations, and in glass-covered and calico-covered frames as well as in the special vapour-tight tent. Plants sprayed with colloidal copper became only slightly affected with the disease.

There was a tendency for plants treated with vapours to become stunted and pale. This was more pronounced when the higher concentration of vapour was used, and with benzol rather than with materials having a lower boiling point.

It was found that the rate of evaporation varied with the material used, the range of temperature experienced during the period of evaporation and also with the material used as a seed-bed covering, as well as the volume of the vapour-tight structure employed.

Experiments are now being carried out at several tobacco centres to confirm these results and to endeavour to evolve a more satisfactory type of vapour-tight tent.

Principles of Botany for Queensland Farmers.

(C. T. WHITE, Government Botanist.)

[*Continued from page* 766, *December*, 1936.]

CHAPTER XXIII.

Dicotyledons.

Subclass Archichlamydeæ.—Perianth either absent or rudimentary (as in the She-oaks or *Casuarinaceæ*), in one whorl or series (as in the Silky Oaks or *Proteaceæ*), or in two whorls, in which case the parts of the inner whorl (corolla) are free.

FAMILY CASUARINACEÆ (SHE-OAKS OR SHEOKES).

Casuarinaceæ is a small family of trees or shrubs. The leaves are reduced to minute teeth arranged in a whorl round the nodes. The number of these teeth in a whorl is an important aid to the identification of the various species. The branchlets are green, and function as ordinary leaves and form phylloclades or cladodes (see page 210) of a rather distinct type. The branchlets are usually grooved, with the stomata sunk in the grooves, transpiration thus being reduced and the trees adapted to a dry situation. The flowers are unisexual, and may be borne on the same or distinct trees. The males are arranged in slender cylindrical amenta at the ends of the branchlets. The structure is very simple. The flowers are arranged in whorls in the same way as the leaves; each male flower consists of a single stamen surrounded by two hood-shaped perianth leaves, which break off at their base as the stamen develops. Below the perianth leaves are two persistent bracts. The female flowers, like the males, are exceedingly simple. They are borne in heads or ovoid spikes (amenta) terminating in short lateral branchlets. Each flower consists of a single carpel subtended by a comparatively large bract and two bracteoles. The single ovary or carpel is surmounted by a style with two long, red, threadlike branches. The stigmas are pointed. The fruit or ripened carpel is a seedlike compressed nut with a smooth shining testa produced at the apex into a membranous wing enclosed within the enlarged and lignified persistent bracts and bracteoles, the whole inflorescence forming a compact woody cone.

The family is a small one, finding its greatest development in Australia and New Caledonia, in both of which countries the trees are a distinctive feature of the landscape. In Australia they are familiarly known as She-oaks or (to use the spelling adopted by the Victorian Naturalists's Club) Sheokes. Eight species are found in Queensland, among the commonest being the Swamp Oak (*Casuarina glauca*), which sometimes forms pure stands in the coastal brackish swamps of New South Wales and Queensland. The Belah or Belar (*C. lepidophloia*) is one of the characteristic trees of inland parts of all the eastern States; it is also found in South Australia and West Australia, but not to the same extent. It sometimes forms almost pure stands, but is more often associated with the Brigalow (*Acacia harpophylla*), producing the familiar Brigalow and Belah scrubs of many parts of Queensland. The Bull Oak (*C. Luehmanni*) is very widely spread through Queensland, and is, in fact, one of the most widely distributed species in Australia. It has a very distinctive sparse, upright growth, and is characteristic of a lot of sandy country a hundred miles or more inland in Queensland, though it is also found nearer the coast. The Red Oak or Forest Oak (*C. torulosa*) is very common on better-class forest country throughout coastal Queensland and New South Wales. It is one of the principal fuel timbers of the State, and great quantities of it are used by bakers, being the favoured bread-baking fuel of coastal Queensland. The River Oak (*C. Cunninghamii*) has a wide range in New South Wales and Queensland, following the river and creek courses, and is a valuable tree for protecting river and creek banks. It is the largest member of the genus, and the wood is prized for the making of bullock yokes. Other species common are the Thready Bark Oak (*C. inophloia*), the Coast Oak (*C. equisetifolia*), and the Black Oak (*C. suberosa*).

FAMILY ULMACEÆ (THE ELMS).

The family *Ulmaceæ* and the two following—*Moraceæ* and *Urticaceæ*—are now regarded as three distinct ones. In older works on the Australian flora, such as the "Flora Australiensis" and Bailey's "Queensland Flora," they were all included under the one family—*Urticaceæ*.

The *Ulmaceæ* or Elms form a family of trees or shrubs with watery sap and with alternate simple leaves. The flowers are hermaphrodite or unisexual, the calyx is 4-8 lobed, the petals absent. The fruit is dry or thinly fleshy, and is often winged.

The species are mainly found in the temperate zone of the Northern Hemisphere, and the family is of relatively small importance in Australia. Of the Australian species, *Aphananthe philippinensis*, the Axe-handle Wood, or native Elm, is a small or medium-sized tree common in the rain-forests of coastal New South Wales and Queensland, and extending northward to the Philippine Islands.

Trema is a genus of trees and shrubs widely spread over the tropical and sub-tropical regions of the globe. *Trema aspera* is the Peach-leaf Poison Bush, the toxic character of which is due to the formation at irregular intervals of a prussic-acid-yielding glucoside.

FAMILY MORACEÆ (FIGS AND MULBERRIES).

Moraceæ, the family which contains the Mulberries and Figs, is composed of trees or shrubs, rarely herbs, usually exuding a milky sap. The leaves are alternate or rarely opposite, stipulate with sheathing bud-protecting stipules, the stipules in most cases early deciduous. The flowers are unisexual, and may be borne on the same or different trees. The calyx lobes are four or less, or sometimes absent. The petals are absent. The actual fruit is a small achene nut or drupe, the product of the ripened ovary; in the mulberries the rachis of the female inflorescence and the calyx lobes becomes fleshy, forming a composite fruit. In the figs the flowers are borne on the inner wall of a fleshy receptacle.

The family is a large one, widely spread over the world, but finding its greatest development in the tropics.

The largest genus is *Ficus*, which comprises the fig trees, which are characteristic features of nearly all dense tropical jungles or evergreen forests. There are about 600 species in different parts of the world, about sixty of which are found in Australia, and, with the exception of three or four, all in Queensland.

The majority of fig trees commence life as epiphytes, the seedlings growing in the fork of the branches, or in cracks or wounds, of various other kinds of trees. Aerial roots are then sent out—first long, slender, flexible roots which, gradually growing longer and stouter, finally reach the ground. These aerial roots keep growing in thickness and strength, and branch and rebranch until they eventually form a lattice-like growth which crushes the life out of the tree on which the seedling fig has started its life. The tree gradually decays, and its rotting wood and bark afford food which is absorbed by the roots of the fig. The whole

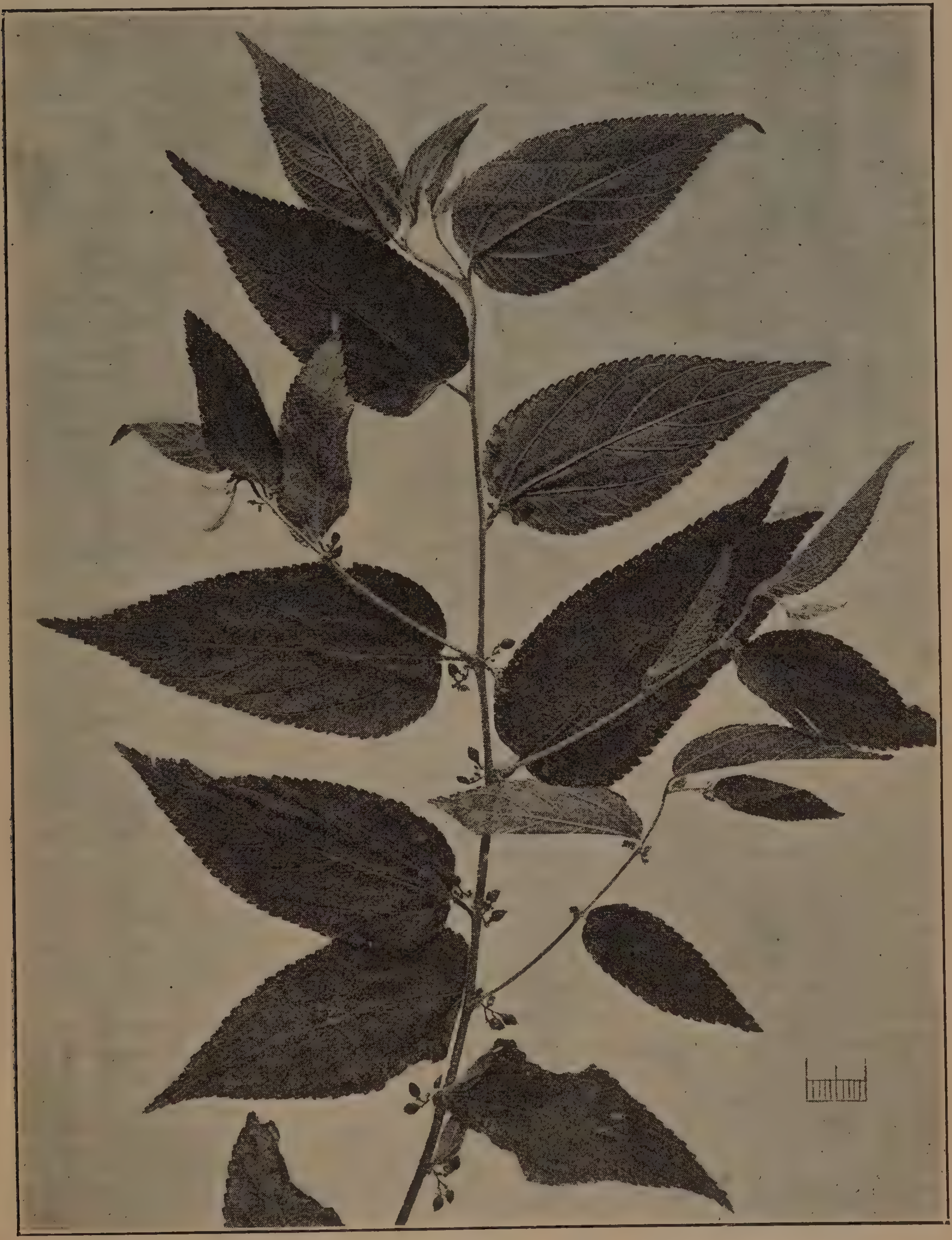

Plate 1.

PEACH-LEAF POISON BUSH (*Trema aspera*).—A common Queensland plant of the Elm family (*Ulmaceæ*).

of the trunk of most figs, with the exception of a small portion near the top of the tree, is thus formed of these aerial roots. Sometimes fig trees send from their branches roots straight down to the ground. These grow into stout column-like props, supporting the branch from which they spring. The branches keep on growing farther and farther out, every now and then sending down another prop-root, until a single tree in this way may eventually cover several acres. Fig trees that have this habit of growth are known as Banyans.

All species do not begin their life in the tops of other trees. A few, such as the common edible fig and the Cluster Fig, found in parts of Central and North Queensland, germinate in the ground in the ordinary way; also, species like the Moreton Bay Fig, which in their natural state start life high up in other trees, in ordinary horticultural and forestry practice are raised in flats or beds in the same way as other plants. The explanation, no doubt, lies in the fact that the young trees are "light-demanders."

The chief botanical characteristic of figs is that the flowers are borne on the inner wall of a closed receptacle. The receptacles are usually borne in pairs in the leaf-axils, but in some species may be borne on the larger branches and even on the trunk right down to the ground. A few tropical species bear the receptacles in clusters upon long branches that run over the surface of the soil and take root here and there. The flowers are unisexual, and there is also a class of neuter or abortive flowers known as gall flowers. The male and female flowers may be borne in the same or in different receptacles, in the latter case the gall flowers being associated with the males.

To understand the peculiar structure of figs, it may be mentioned that fertilization is dependent on the work of different species of fig-wasps, and the gall flowers are not the result of insect agency, but their peculiar structure rather determines the selection of them by the insect for the reception of its eggs. The gall flowers thus act as protectors to the seed-bearing flowers, which otherwise would probably be attacked by the fig-wasps, with the consequence that the grub afterwards developed would destroy the seed. The emergence of the pupa from the gall flowers takes place when the pollen is being shed from the male flowers, and the mature insect takes away with it a certain amount of pollen, which, somehow or other, is conveyed to the female flowers. It is thus seen that the gall flowers play an important part in the life history of the plant, not only protecting the female flowers from the attacks of the gall insects, but also insuring them later being pollinated by pollen from the male. Fig trees yield a rubber which varies in quality, according to the species yielding it. The only species of any commercial importance in this respect are the India Rubber Tree of India (*Ficus elastica*), and in a few species from tropical West Africa. The rubber formed from the juices of the common Moreton Bay Fig and other Australian species, so far as has been tried, has not proved to be of any commercial value. The inner barks of fig trees yield a strong fibre much used by the aborigines in the manufacture of twine, string-bags, fishing-nets, &c. The wood of fig trees is generally light and not very durable; hence it is only used for case-making and similar purposes.

Other important genera are *Morus* and *Artocarpus*. The former includes the Mulberries. The Black Mulberry (*Morus nigra*) is very abundant in cultivation in Queensland. The White Mulberry (*Morus alba*) possesses a fruit of very poor quality, but is extensively planted in Southern Europe and other countries for silkworms, the silk produced being reputed of better quality than when the Black Mulberry is used as the food plant.

Artocarpus includes the Bread-fruit (*A. incisa*), very common throughout the Southern Pacific and an important article of food among the natives and the Jak (or Jack) Fruit (*A. integrifolia*), grown to a limited extent in Queensland. The true Bread Fruit is not to be confused with the Pandanus tree—common along the coast and often called "Bread fruit" by Queenslanders.

FAMILY URTICACEÆ (THE NETTLES).

The Family *Urticaceæ,* as now recognised, is a comparatively small one of herbs, shrubs, or soft-wooded trees often armed with stinging hairs. The leaves are simple, alternate or opposite. The flowers are unisexual, the calyx lobes 4 or 5, petals absent; in the female flowers the calyx often becomes enlarged and fleshy in fruit. The fruit is a dry achene or fleshy drupe.

Nine genera occur in Queensland, one containing trees. The family contains the Stinging Nettles, the genus Urtica, of which two species are very common in Queensland—the one *Urtica incisa,* a common herb or small shrub on "scrub" (rain-forest) edges in Queensland, the other the common English Nettle, *Urtica urens,* naturalised and common in South-Eastern Queensland, particularly on the Darling Downs, and in the cooler parts of the State generally.

The genus Laportea is widely distributed through the tropical regions of the world, and three species occur in Australia—all in Queensland. The Giant Stinging Tree (*Laportea gigas*) attains the dimensions of a very large tree; another—the Shining-leaf Stinging Tree (*L. photiniphylla*)—is a medium-sized tree; while the third—*L. moroides* (the Gympie)—is only a shrub. The characteristic feature of the trees is the irritating sting they inflict when brushed against the naked skin. This irritation varies in intensity with the different species. In some of the Laporteas the effects of the sting may last for months, being noticeable every time cold water comes in contact with the flesh.

When examined closely, the leaves of the Stinging Trees are seen to be clothed with innumerable minute hairs, with here and there larger ones scattered among them. These larger hairs take the form of hollow brittle tubes, and are filled with a strong acid. They usually arise from a raised mound or cushion and taper gradually to the apex. They are terminated by a small head, which breaks off at the lightest touch. When the sharp, broken point of the hair pierces the skin, it pours out the strong acid contained in the hollow part of the hair.

FAMILY PROTEACEÆ (SILKY OAKS).

Proteaceæ is a family of woody plants of very characteristic structure. The leaves are mostly alternate, rarely opposite or whorled, and are simple or variously divided. The flowers are mostly hermaphrodite, though sometimes unisexual. They have only the one series of perianth segments. In Bentham's "Flora Australiensis" and Bailey's "Queensland Flora" the floral parts are simply referred to as perianth segments. In his "Families of Flowering Plants," Hutchinson regards them as sepals or calyx lobes. Some authors regard them as petals, basing their decision on the similarity of the flowers to those of their close allies, the *Loranthaceæ* or Mistletoes. On the other hand, Hutchinson may be right, and perhaps the hypogynous glands represent a very modified corolla. Under these circumstances of doubt, it is perhaps perferable to use the term "perianth segments," as adopted by Bentham, Bailey, and others. The perianth segments are four in number, and are usually united into a tube in the bud stage and variously split when open. The stamens are epipetalous—*i.e.,* attached to the petals and appearing as if they had grown out of them—rarely free. The ovary may be sessile or narrowed into a stalk (called the stipes) at the base. The fruit is various, being a nut, drupe, follicle, or capsule. The seeds are without endosperm, and in the follicular fruits are usually winged.

The family is a large one of about 1,000 species, distributed through fifty genera widely spread over the world, but poorly represented in the Northern Hemisphere and finding its greatest development in Australia and South Africa, particularly in the former country, where about 650 species are found. About 300 are found in South Africa, and the few remaining species are scattered over the Pacific Islands, New Zealand, South America, and tropical and temperate Asia.

The distribution of the family is rather remarkable. It reaches its greatest development in South Africa and Australia, but none of the genera are common to the two countries. South America, on the other hand, possesses two genera common to Eastern Australia and to the mountainous regions of West South America. Of these two genera, *Lomatia* has three species in South America and six in Australia; *Embothrium* has four species in South America and one or several in Australia, according to the view taken of the genus; *Helicia* is one of the few genera that extends to the Northern Hemisphere, several species being found in the southernmost islands of Japan. It is quite common in Eastern Australia, extending from the far North southwards to the Northern Rivers district of New South Wales.

To the Queenslander, the main interest in *Proteaceæ* arises in the beauty and value of the timbers, several of which are cut and sold indiscriminately under the name of Silky Oak. In previous years the familiar *Grevillea robusta* provided all the Silky Oak of the trade, but now practically all comes from various North Queensland trees—mostly *Cardwellia sublimis.* The outstanding feature of the wood is the great width and depth of the medullary rays, which give rise to the characteristic oak figure when the timber is radially or quarter cut, as is the general practice in Queensland with fancy timbers such as the Silky Oak and Maple.

The original Silky Oak of the Australian trade was the product of *Grevillea robusta* of South-eastern Queensland and Northern New South Wales. In Southern Queensland and in New South Wales a certain amount of the timber of *Orites excelsa* was also cut. In Queensland, this tree is found at altitudes of 2,000 feet and over. It is very well developed in the Killarney district, and is sometimes known as Killarney Oak. The commonest Silky Oak of the trade at present is *Cardwellia sublimis,* a large tree of the North Queensland rain-forests.

Silky Oak seasons well and rapidly, and is one of the most workable and ornamental of cabinet woods. It can be carved, veneered, bent, glued, and stained or polished with equal readiness. It is light, but firm and strong, and holds nails better than most timbers In North Queensland it is used for general building purposes, even as weatherboards, and generally for doors and window sashes.

Macadamia is a genus of three or four species confined to Eastern Australia, and finding its greatest development in Queensland. The principal characteristic of the genus is its fruit, consisting of a coriaceous pericarp split into two valves and enclosing one or sometimes two seeds. The seeds are enclosed in a very hard, bony, usually brown, and shining testa. The leaves are verticillate, opposite or alternate, toothed or entire. The flowers are borne in slender, either simple or branched racemes. The best-known species is *M. ternifolia*, the common Macadamia Nut, Queensland Nut, or Australian Bush Nut, unquestionably one of the finest flavoured nuts in cultivation. Many forms have been recognised, and the tree shows considerable promise as an economic nut producer. A remarkable feature about this tree is that, though it is a native of Southern Queensland and Northern New South Wales, and normally found in heavy rain-forest country with 45 to 70 inches of rainfall, the leaves remind one, by their leathery nature, of a xerophytic rather than a mesophytic type, and the tree has been found in cultivation to be fairly drought-resistant.

The seeds of two other species of the genus—namely, *M. minor* of South-East Queensland and *M. Whelani* of North Queensland—both contain a prussic-acid-yielding glucoside, and are only edible after the glucoside has been destroyed by washing and heat. Another species—*M. praealta*, the Ball Nut of South Queensland—is common in parts of the Wide Bay district. It is rather different from the other species of Macadamia in general appearance; the seed is not known to possess any poisonous properties, though it has an exceedingly bitter taste, which renders it of no value as a nut producer.

FAMILY LORANTHACEÆ (THE MISTLETOES).

The Loranths or Mistletoes are shrubs parasitic on trees or are very rarely erect terrestrial trees. The leaves are mostly opposite, and are sometimes reduced to scales. The flowers are hermaphrodite or unisexual, and are often brightly coloured; the perianth is double (*i.e.*, with both calyx and corolla) or apparently single by suppression of the calyx limb. The calyx-tube is adnate to and encloses the ovary. The petals are 4 to 8, free or united, stamens as many as the petals, opposite to them and usually epipetalous. The fruit is a berry with a solitary seed devoid of testa.

Loranthaceœ is a large family estimated to contain about 500 species, most of which are tropical and sub-tropical. The family is represented in Australia by about fifty species. Strange to say, none occur in Tasmania.

Mistletoe are parasites, or, rather, partial parasites, which live upon various kinds of trees, deriving their water supply and mineral food constituents from them. By means of green leaves or branchlets they can make the whole or at least part of their organic food by photosynthesis (see pages 617 and 619), though they probably obtain some organic food needful for their life from the host. The plants enfeeble the branches of the trees upon which they are parasitic, and are directly injurious by allowing the entrance of destructive insects and fungi at the swollen cankered places which are often produced where they take root.

The only method of eradicating and diminishing the attacks of Mistletoes is by cutting off the infested branches. Breaking off the branches of Mistletoes is of little or no use, as it usually only stimulates adventitious growth.

Mistletoes vary a good deal in regard to their choice of hosts. Some species show distinct preferences in this respect; others attack numerous species of trees indiscriminately. *Notothixos subaureus* is almost invariably parasitic on other species of Mistletoes. Sometimes there is a close similarity in general facies of the parasite to its host, thus *Loranthus linophyllus* is almost invariably found growing on *Casuarina,* and *L. pendulus* on *Eucalyptus.* Most are quite dissimilar to the host tree. Some are found on a number of trees, but favour some kinds more than others. *L. Bidwillii* I have not seen on trees other than Cypress Pines (*Callitris* spp.). *L. congener* is very common on most trees, but favours *Casuarina. L. vitellinus* is very common on most trees, but favours *Tristania suaveolens* (Swamp Mahogany).

The fruit of Loranthus is a one-seeded, commonly somewhat transparent berry. The seed is enclosed in a viscid and rather sweet pulp, which, when exposed to the air, dries rapidly. Birds carry the seed from tree to tree. Although numbers of seeds pass through the alimentary canal of the birds, a greater portion are rejected after having their exterior covering removed. These falling may adhere to branches, and in a short time become firmly cemented on the upper surface and sides.

The germination and life history of one of the common Australian Mistletoes (*Loranthus exocarpi*) has been studied by C. C. Brittlebank, and his observations published in the "Proceedings of the Linnean Society of New South Wales" (Vol. XXXIII.). The following notes are based on his work.

Seeds which have passed through the alimentary canal of birds germinate as readily as those which have fallen directly from the parent plant. If the seeds fall on larger branches covered with a thick layer of dead bark, they are unable to penetrate to the soft underlying cortex, and perish; owing to this fact, Mistletoes are generally found to start life upon thin limbs or on branches which have clean, tender, and sappy bark. The embryo runs through the longer axis of the seed, and is completely surrounded by a store of plant food (albumen), the whole of which—both embryo and albumen—is stained green by chlorophyll. The germination period varies greatly, in some cases the seeds starting to germinate within one or two days, but in other cases germination may be delayed for a couple of months. Germination having begun, the hypocotyl emerges from a terminal pore which up to this time it had filled, somewhat after the manner of a stopper in the neck of a flask. The hypocotyl may bend downward towards the branch, but in many cases it bends upwards and over the seed, reaching the branch behind. As the axis of the embryo lengthens, it becomes covered by little processes. The extremity of the hypocotyl becomes enlarged, club-shaped, and papillose. This and the clavate processes exude a clear liquid, which plays a most important part in the life of the plant. This fluid comes in contact with the bark of various plants, at once penetrating its structure, softening and partly dissolving the cellulose matter, and at the same time cementing the apex of the radicle, which now becomes flattened and disklike, to the branchlet of the host. The end of the hypocotyl now becomes rapidly enlarged, spreading out into a hemispherical mass. The cells of the distal surface grow out and enter the host as papillæ. The cotyledons may remain within the seed-coat or be carried up, in this case commonly acting as protective leaves to the young plumule. As soon as penetration of the host is effected growth becomes very rapid. It often happens that before much leaf-growth is made a large tubular aerial root is thrown out from the sucker, and this root grows rapidly along the branch, soon seeking the under side. Here and there along these lateral aerial roots large suckers arise from which roots of the parasite penetrate the host. As growth develops, a wedge-shaped root or sinker passes down into the wood of the host, which it penetrates in various ways, according to the species of Loranth and the nature of the host wood which it invades.

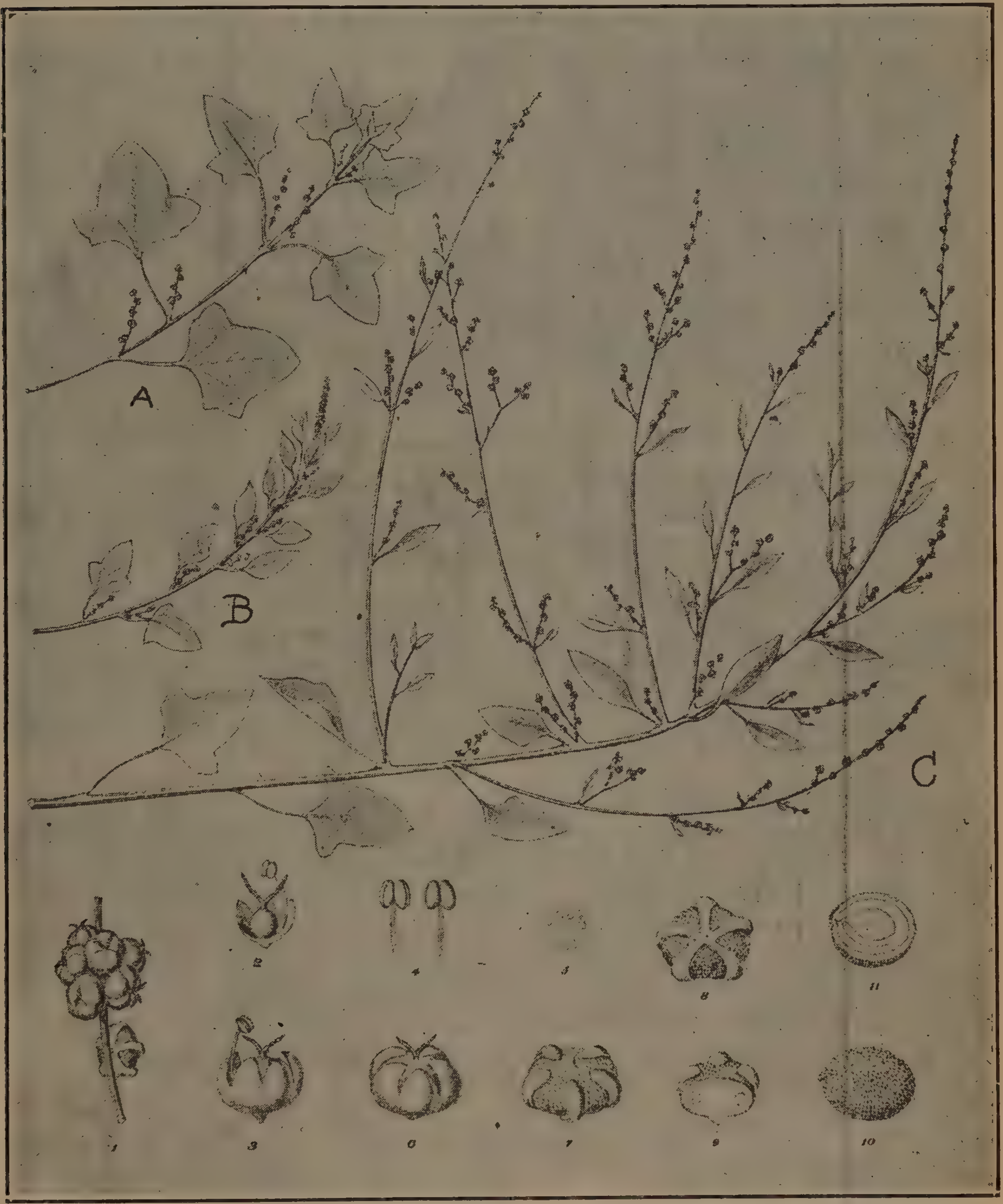

Plate 2.

Goosefoot (*Chenopodium triangulare*), R. Brown. A very common plant of the Salt-bush Family (Chenopodiaceæ) A, B, and C.—Shoots somewhat reduced.

1.—Portion of branchlet bearing flowers.
2.—A flower, part of the calyx removed.
3.—A flower.
4.—Back and front view of a stamen.
5.—Pollen grain.
6.—A young fruit.
7 and 8.—Mature fruits (seeds).
9.—Longitudinal section of a fruit.
10.—A seed.
11.—Transverse section of seed.
1-11.—Variously enlarged.

(After Mueller in "Iconography of Australian Salsolaceous Plants.")

FAMILY CHENOPODIACEÆ (SALTBUSH FAMILY).

Annual or perennial herbs or shrubs. Leaves usually alternate. Flowers small, commonly green and insignificant, hermaphrodite or unisexual. Sepals 5, persistent, and often enlarged in fruit. Petals absent. Stamens 1-5. Ovary superior. Fruit, a seedlike nut.

The family is of most interest to the Australian farmer and pastoralist, on account of the number of edible shrubs (top-feed) and herbs it contains. Most of these are familiarly known as Saltbushes.

The edible Saltbushes belong to several distinct groups or genera, the three most important being *Atriplex, Chenopodium,* and *Rhagodia, Atriplex,* the largest, is widely spread over the warmer regions of the globe, but in countries other than Australia the species are mostly confined to sandy lands near the sea. *Atriplex nummularia* is the Old Man Saltbush, a shrubby species extensively planted both as a fodder plant and as a hedge. One of the commonest and most widely spread in Queensland is *A. Muelleri,* mostly known as the Annual Saltbush or Saltweed, a species that comes up in tremendous abundance following both autumn and spring rains. It grows to a height of 18 inches to 2 feet. Considerable divergence of opinion exists as to its palatability, but, on the whole, stock seem to reject it when other feed is available, though they will eat it at times, particularly when it is drying off.

Widely spread in different parts of the State, and particularly common on cleared Brigalow and Belah country on the Darling Downs and in the Maranoa district, is the Creeping Saltbush, *A. semibaccata.*

The genus *Chenopodium* is a large one. The species occur in different parts of the world—mostly as weeds of cultivation. In England and America they are frequently referred to as Goosefoots, owing to the common shape of the leaves being like the foot of a goose, but in Queensland the various forms of Fat-hen belong to the genus *Chenopodium,* the commonest being *Chenopodium album.*

In addition to the ones growing as introduced weeds, there are twelve native species, and some of these are of considerable value as fodders. Perhaps the best is the Blue Bush, *C. auricomum,* an upright growing species of the interior, mostly about 3 feet high, and producing a large amount of edible leaf.

Rhagodia is very similar to *Chenopodium* in general appearance, but has small, fleshy fruits, those of *Chenopodium* being quite dry. One of the Rhagodias—namely, *R. hastata*—is commonly used as a hedge plant, and some beautiful hedges of it can be seen about Toowoomba and other parts of the Darling Downs.

All the Saltbushes are not good fodders. The family is a very large one, and some of them are common weeds, more especially plants of the genus *Bassia,* several of which are common pasture weeds in Queensland. The best known is perhaps the Galvanised Burr, *Bassia Birchii.*

Important vegetables belonging to this family are the Beetroot, *Beta vulgaris,* and the Spinach, *Spinacia oleracea.* The Silver Beet mostly cultivated in Queensland as Spinach is a variety of the common Beetroot, *Beta vulgaris.* It is regarded by some botanists as a distinct species, *Beta Cicla.*

FAMILY ANNONACEÆ (CUSTARD APPLE FAMILY).

A family of trees, shrubs, or woody climbers. Leaves alternate, simple, entire. Flowers sessile or pedicellate, solitary or clustered. Sepals 3, usually free, but sometimes united into a toothed or lobed calyx. Petals mostly 6, sometimes 3 or 3 large and 3 much reduced. Stamens numerous, closely packed on the thickened torus or floral receptacle. Pistil usually composed of numerous carpels, free and distinct from one another. Fruit composed of several free carpels (berries) or a syncarp, as in the Custard Apple and its allies, formed by the growing together of the carpels and floral receptacle into a fleshy mass.

The family is widely spread over the tropical and sub-tropical regions of the world. A number of species are natives of the rain-forests or jungles of coastal Queensland. The most important genus, from an economic standpoint, is *Annona,* which contains the Custard Apple, *A. squamosa,* the Cherimoya, *A. Cherimola,* the Sour Sop, *A. muricata,* and the Bullock's Heart, *A. reticulata.* Most of the species of *Annona* come from tropical America. The name is usually spelt "Anona," but W. E. Safford, an American botanist, who has paid particular attention to these fruits, says the correct spelling and the one adopted by Linnæus (see page 748) is "Annona."

FAMILY LAURACEÆ (LAUREL FAMILY).

Lauraceæ is a family of trees or shrubs with alternate leaves, or in one genus—*Cassytha*—reduced to leafless parasitic twiners. The flowers are small, hermaphrodite or unisexual, and borne in panicles, though sometimes in racemes or spikes. The perianth tube is short; the lobes are usually six in number, but vary from three to six. The stamens are 3-9, or indefinite; the anthers open by valves. The fruit is a berry or drupe; the perianth entirely deciduous, as in *Endiandra,* or the tube enlarged and cup-shaped under the fruit, as in *Litsea* and *Cinnamomum,* or entirely closing over and adnate to it, as in *Cryptocarya.* The seed is ex-albuminous (see page 386 and plate 176), with large cotyledons.

The family is a large one, containing about 1,000 species distributed through forty genera, mainly tropical, but extending to the temperate regions of both the Northern and Southern Hemisphere. About fifty species are found in Australia, and all of these, with the exception of one or two members of the parasitic genus *Cassytha,* are found in Queensland. With the exception of the genus *Cassytha,* the species are all trees. They are common in Eastern Queensland and Northern New South Wales, and in many cases represent a fairly large percentage of the trees in the rain-forests or jungles.

The Laurels, though they represent a fair proportion of the trees in many of the rain-forests of coastal Queensland, yield only a few important as timber species. The most important is the North Queensland Walnut, *Endiandra Palmerstoni.* This is one of the largest and commonest trees of North Queensland, and a good deal of the timber, particularly of the walnut butts for veneer manufacture, has been exported abroad, largely to the United States.

The family contains the Avocado (*Persea gratissima* or *P. americana*), a native of tropical America now widely cultivated in tropical and sub-tropical countries. A peculiar feature that has been much studied of late is the sex-reversal of the one-day flowers. Some flowers mature the male organs (the stamens) first, and the female organ (the pistil or gynæcium) later. These are known as protandrous flowers. Others have the reverse action, the pistil maturing first and the anthers later. Such flowers are called protogynous. The flower types of numerous commercial varieties have been worked out by Dr. A. B. Stout, of the New York Botanic Gardens. The value of this work to the orchardist is that an intermingling of the protandrous and protogynous types should result in a bigger fruit crop than the one type alone.

FAMILY CRUCIFERÆ (THE CRUCIFERS OR CABBAGE FAMILY).

A family of annual, biennial, or perennial herbs. Leaves simple, alternate, or, more rarely, opposite. Flowers mostly arranged in racemes. Sepals 4, petals 4, or in a few cases absent. Stamens 6, two shorter than the other four. Pistil or gynæcium simple. Fruit an elongated pod (often termed a siliqua) or short pod (often termed a silicule), bi-valved or indehiscent.

Cruciferæ is a large family, finding its greatest development in the temperate regions of the world. Its useful members include many vegetables, as the Cabbage (*Brassica oleracea*), Turnip (*Brassica Rapa*), Radish (*Raphanus sativus*), Cress (*Lepidium sativa*), Water Cress (*Nasturtium officinale*), &c. It contains many garden flowers, as Stocks (*Matthiola*), Wallflowers (*Cheiranthus*), &c. Some of the species are very common weeds of cultivation and pasture land in Queensland; most of them give a very objectionable odour and flavour to milk and cream. They are familiarly known as Mustard or Turnip Weeds.

FAMILY PASSIFLORACEÆ (THE PASSION FRUITS).

A family of climbers or, more rarely, trees. Leaves alternate, often with glands on the leaf-stalk. Flowers mostly hermaphrodite, sometimes unisexual. Sepals 5, free or partly united. Petals 5, rarely absent. A corona is present, usually composed of one or more rows of threadlike filaments, sometimes annular or composed of scales. Stamens 5 or more, ovary 1-celled, with several parietal placentas (see page 376) and numerous ovules. Fruit a berry (or, rarely, a capsule); seeds numerous, with a pitted surface.

Passifloraceæ is a family widely spread over the tropics and subtropics of the world. It includes the common Passion Fruit (*Passiflora edulis*), the Granadilla (*Passiflora quadrangularis*), the Banana Passion Fruit (*Tasconia mollisima*), and other species less frequently seen, as the Yellow or Sweet Granadilla (*Passiflora ligularis*) and the Sweet-cup (*Passiflora laurifolia*). Several native species are found in Queensland, the two commonest being *Passiflora Herbertiana* and *P. aurantiaca,* which contain a prussic-acid-yielding glucoside (see page 614), and may cause the death of cattle that eat heavily of them. The White Passion Vine (*Passiflora alba*) is very common in many localities, especially as secondary growth on cleared country, growing over old logs in fallen scrub and in the better-class forest country. In times when grass is scarce, particularly towards the end of spring and beginning of summer, the young shoots are eaten by stock. Repeated tests of the leaves of Queensland material for the presence of a prussic-acid-yielding glucoside have given negative results; so some other poisonous body must be the cause of the trouble experienced with this plant. Feeding experiments with this vine were carried out by the late Dr. Sydney Dodd, and his results published in the "Queensland Agricultural Journal" for February, 1910. The symptoms as described

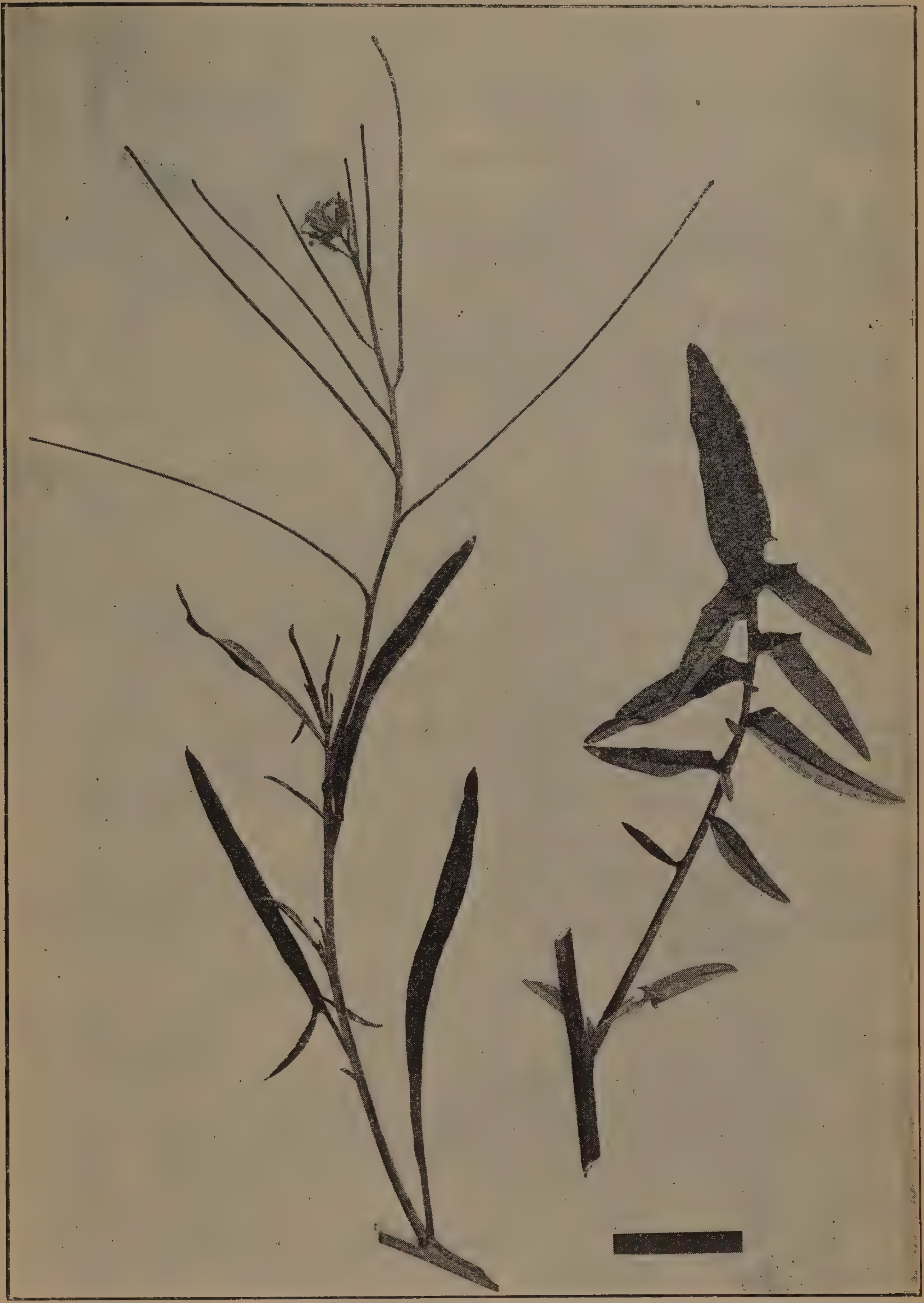

Plate 3.

TUMBLING MUSTARD (*Sisymbrium orientale*).—A plant of the Cabbage family or Cruciferæ.

by him are certainly not those of prussic acid poisoning, for a feature brought out by the investigation was that the poisonous property of the vine is of a cumulative nature, and evidently quite considerable quantities of it have to be eaten before any ill-effects are noticed. This accounts for the fact that no cases of poisoning are heard of in many localities where stock are habitually running in paddocks overrun with the vine.

FAMILY CARICACEÆ (THE PAPAW AND ITS ALLIES).

A family of soft-wooded (almost herbaceous) trees or shrubs. Leaves alternate, usually digitately lobed or divided and clustered towards the tops of the trunk or branches. Flowers unisexual, borne in panicles, the male panicles usually large, females small and few-flowered. Male flower: Calyx 5-lobed; petals 5, united in the lower part into a slender tube; stamens 10; a rudimentary ovary may or may not be present. Female flower: Calyx 5-lobed; petals 5, united or at length quite free from one another. Ovary superior, with parietal placentation. Fruit a large berry, usually with numerous seeds, but the ripe seeds sometimes few or entirely absent in cultivated plants.

The family is a small one of about fifty species, natives of tropical America. The largest genus is *Carica,* the fruits of several species of which are edible. The most important economic species is the common Papaw (*Carica Papaya*), widely cultivated throughout the tropics and sub-tropics of the world as a fruit.

FAMILY CUCURBITACEÆ (THE CUCURBITS OR MELON AND CUCUMBER FAMILY).

A family of herbaceous or woody climbers or prostrate creepers, the tendrils spirally coiled. Leaves alternate, variously lobed. Flowers unisexual. Calyx 5-lobed or toothed. Corolla gamopetalous or of five free petals. Stamens 1-5, usually three; one anther always 1-celled. Ovary inferior. Fruit a berry; seeds usually flattened and numerous.

The family is widely spread over the world. Many of the species are important crop plants, such as the Pumpkin (*Cucurbita Pepo*), Cucumber (*Cucumis sativus*), Rock Melon (*Cucumis Melo*), Water Melon (*Citrullus vulgaris*), &c.

FAMILY GUTTIFERÆ (MANGOSTEEN FAMILY).

Guttiferæ is a family of trees or shrubs. Leaves opposite, without stipules, sometimes with translucent oil or resin dots. Flowers variously arranged—single, in clusters, or in cymes or panicles; unisexual or hermaphrodite. Sepals 2-6, free or slightly united. Petals 2-6. Stamens numerous, free or united at the base into one or several bundles. Ovary superior, stigmas radiating out from the top of the ovary, or united; sessile or with a distinct style. Fruit a berry (*Garcinia*) or drupe (*Calophyllum*).

The family is entirely tropical and contains the Mangosteens (genus *Garcinia*). Five native species occur in Queensland. The common Mangosteen of the East, rarely grown in Queensland, is *Garcinia Mangostana.* An inferior species (*G. Xanthochymus*) is sometimes cultivated in North Queensland gardens. Another genus is *Calophyllum,* represented in Queensland by three species, one of which (*C. inophyllum*) is much grown as a street and esplanade tree in North Queensland. It is widely spread over the Indian, Malayan, and Pacific regions. It is

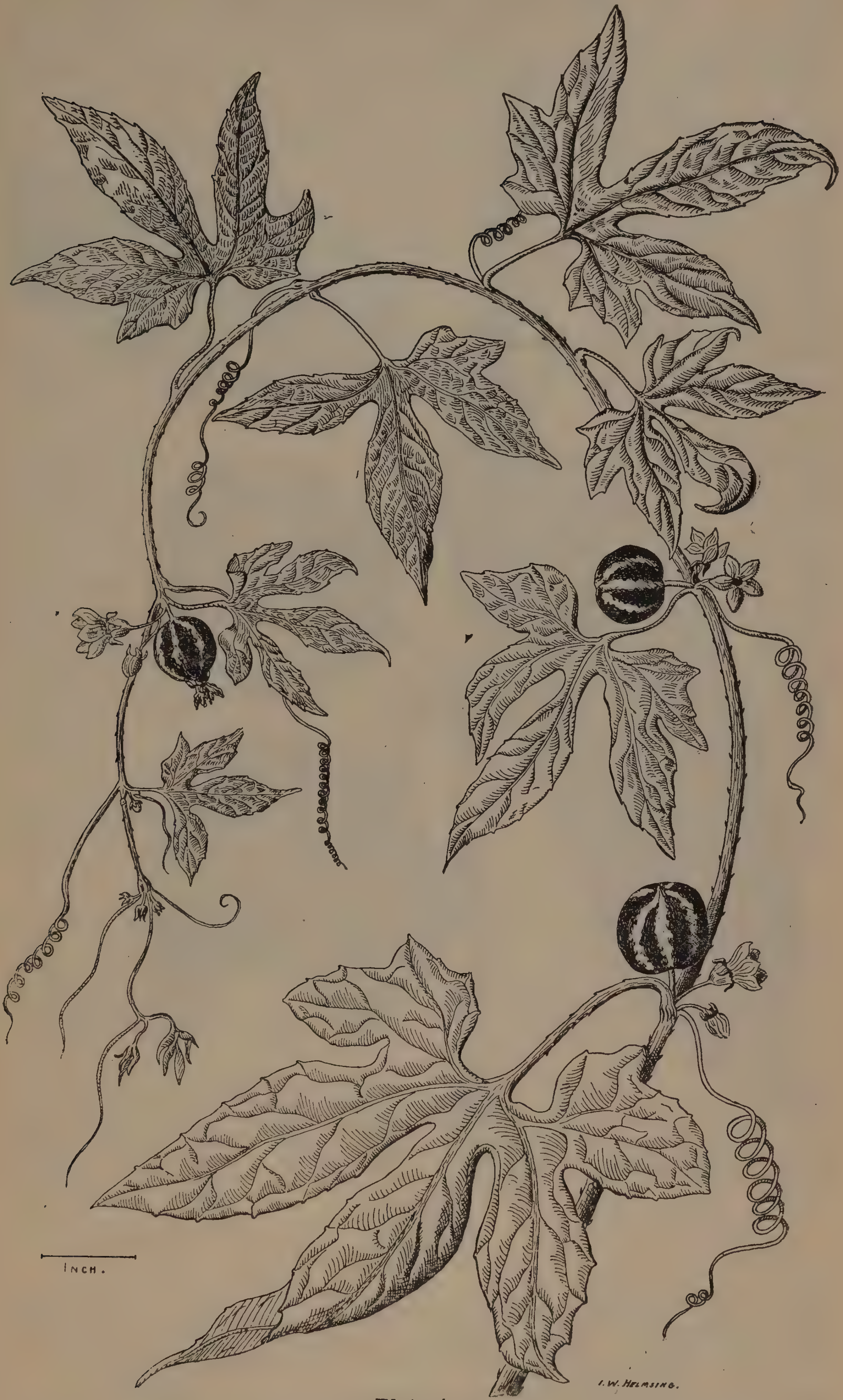

Plate 4.

NATIVE BRYONY (*Bryonia laciniosa*).—A native vine of the Family Cucurbitaceæ. The fruits are red with white wavy lines, and are poisonous.

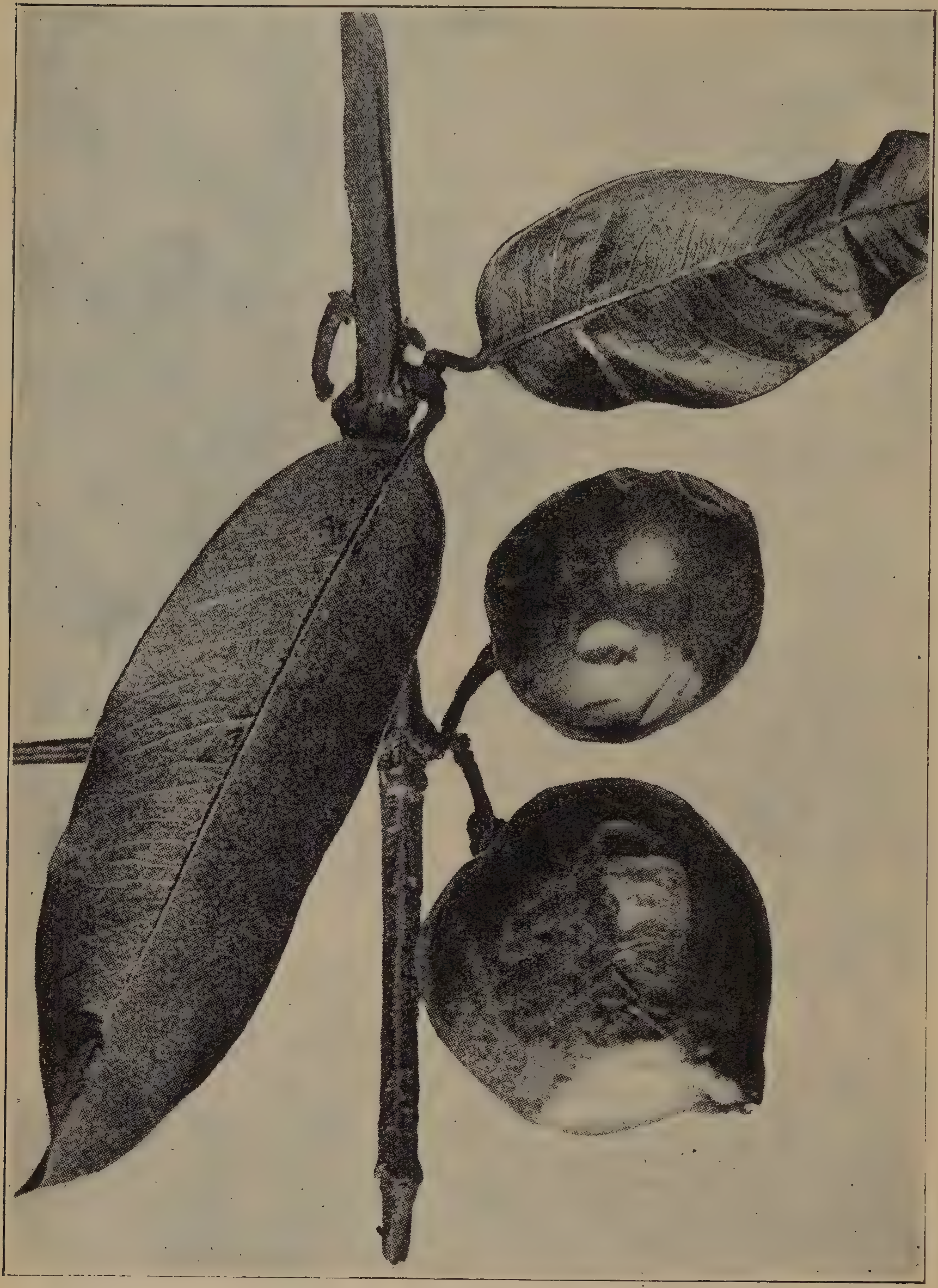

Plate 5.

FAMILY GUTTIFERÆ (*Garcinia Xanthochymus*).—An inferior mangosteen grown to a limited extent in North Queensland.

sometimes known as the Alexandrian Laurel. Another species (*C. costatum*) is confined to North Queensland. The timber under the name of *Calophyllum* is extensively used for general building purposes.

FAMILY MALVACEÆ (THE MALLOW FAMILY).

A family of herbs, shrubs, and trees, usually with a fibrous bark. Leaves alternate, stipulate, but the stipules sometimes soon falling and only seen in the bud stage. Flowers mostly hermaphrodite, sometimes unisexual. Sepals 3-5, in some genera, such as *Hibiscus* and *Gossypium* (cotton), surrounded by a ring of bracteoles (called an epicalyx). Petals 5, free, but often joined at the base to the staminal column; stamens numerous, joined together in a staminal column; anthers 1-celled. Ovary 2-many-celled. Fruit a dry capsule or breaking up into cocci or mericarps (see Plate 170).

The family is widely distributed over the world. Some are very common farm weeds in Queensland— *e.g.*, "Sida retusa" (*Sida rhombifolia*), Button Mallow (*Modiola*), &c. Several are cultivated as ornamental shrubs, particularly members of the genera *Abutilon* and *Hibiscus*. Both these latter are well represented by native species in the Queensland flora. The bark of many yields a strong cordage. The most important economic genus is *Gossypium*, which includes the Cotton (*G. herbaceum*) and Sea Island Cotton (*G. barbadense*).

FAMILY STERCULIACEÆ.

A family of herbs, shrubs, or trees, very closely allied to the Mallows, differing chiefly in the 2-celled—not 1-celled anthers. The leaves are much lobed and divided or entire.

The calyx is 3-5 toothed or lobed. Petals 5, reduced to small scales or entirely absent. Ovary 2-5 celled, the carpels united or more or less distinct. Fruit either a capsule or composed of a number of distinct follicles as in *Sterculia* and *Brachychiton.*

The family is a fairly large one, finding its greatest development in the tropics. It is well represented in the Queensland flora, the largest genus being *Brachychiton,* which contains the Kurrajong (*B. populneum*), the Northern Kurrajong (*B. diversifolium*), the Bottle Tree (*B. rupestre*), Broad-leaved Bottle Tree (*B. australis*), the Flame Tree (*B. acerifolia*), and other trees. The genus is separated from *Sterculia* on very slender grounds, but as most recent works on the Australian flora retain it, I have followed suit. The most readily observable distinction is that the seeds and inside of the capsule are smooth in *Sterculia* and hairy in *Brachychiton.*

Sterculia quadrifida is very common, and is often known as Peanut Tree. The fruits are bright red when ripe, and the seeds a dull black with an edible kernel. The only other species of *Sterculia* in Queensland is *S. laurifolia,* a common tree in some of the North Queensland jungles or "scrubs."

FAMILY RUTACEÆ.

The family *Rutaceæ* consists of trees, shrubs, or, more rarely, herbs with simple or compound glandular-dotted leaves. The flowers are mostly regular and 4- or 5-merous. The ovary is superior, the carpels free or united. The fruit is various, being a berry, as in *Citrus*, a drupe, as in *Halfordia* or Saffron Heart, a samara, as in *Pentaceras*, the Bastard Crow's Ash, or a capsule, as in *Flindersia,* Crow's Ash, Maple, &c.

Rutaceæ is a very large family estimated to contain about 700 species widely spread over the world, mostly in tropical and sub-tropical countries. The family is strongly represented in Australia, and contains one of our most important genera of timber trees—namely, *Flindersia.* In the "Queensland Flora" and older works of Australian authors this genus is included in the *Meliaceæ,* but more modern authors have generally classed it along with *Rutaceæ.* Its glandular-dotted leaves and, on

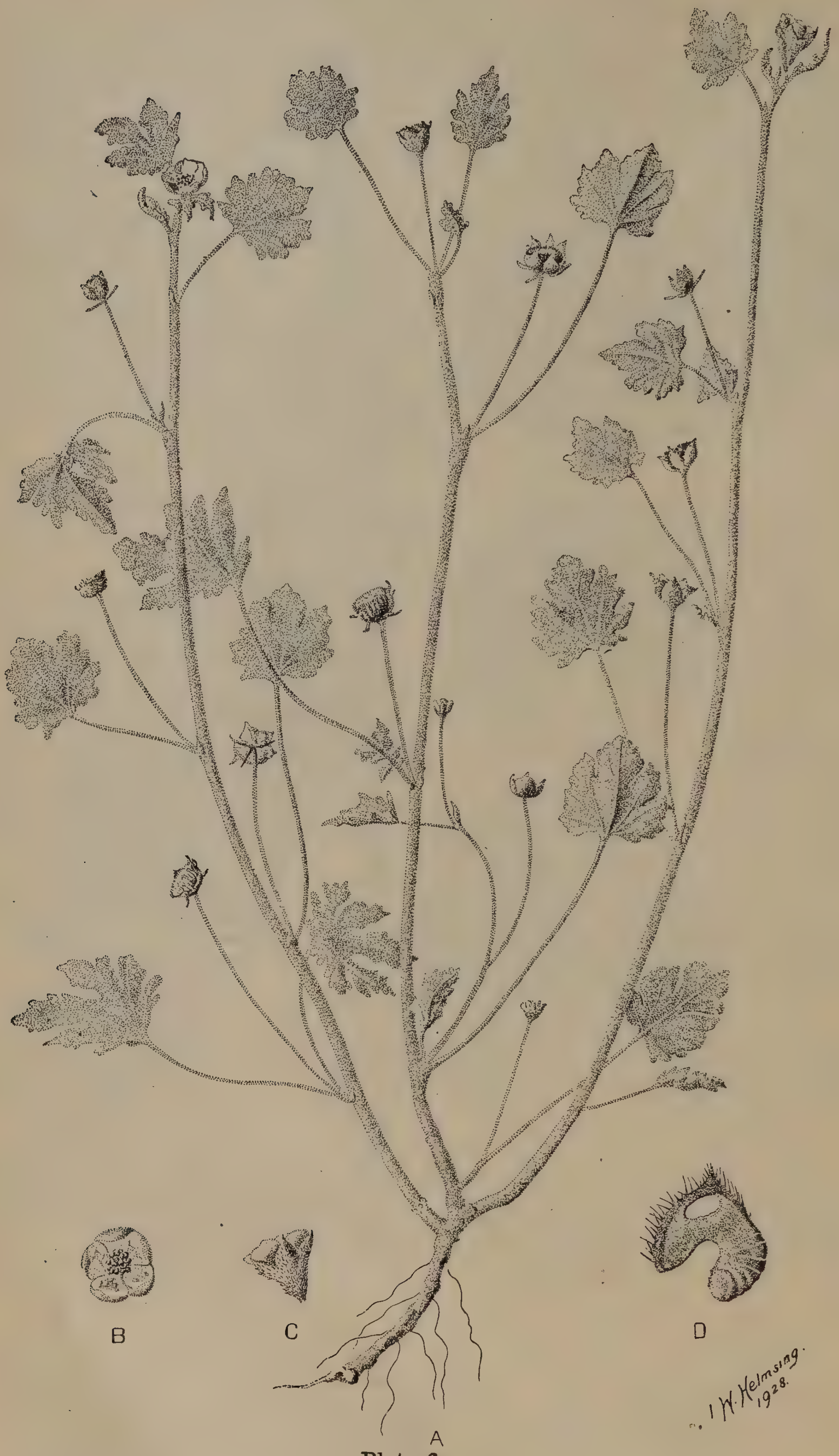

Plate 6.

Button Mallow (*Modiola caroliniana*).—A member of the Mallow family (Malvaceæ).

A. Plant about half natural size. B. Single flower (face view). C. Single flower (back view). D. Ripe carpel or mericarp containing seeds.

the whole, its timber structure place it in this family rather than in the *Meliaceæ.* In some respects the characters belong in part to both families, and perhaps a new family to receive it should be made.

The family contains the *Citrus* fruits, as the Orange (*Citrus aurantium* or *C. sinensis*), Lemon (*Citrus limonum*), Grape Fruit (*Citrus grandis*), Kumquat (*Fortunella japonica*), Citron (*Citrus medica*), &c. Several citrus fruits are natives of Queensland; they have been separated from *Citrus* proper by W. T. Swingle, an American botanist, under the generic name of *Microcitrus,* on the grounds of their dimorphic foliage (the leaves on juvenile plants being different from those on the adult), their small flowers with free—not united—stamens, and their few-celled fruits with stalked pulp vesicles. Four species have been described—the Native Orange (*M. australis*), the Finger Lime (*M. australassica*), the Russell River Lime (*M. inodora*), and Garraway's or the Peninsula Lime (*M. Garrawayi*). Another tree of the *Citrus* group, a native of Queensland and of New South Wales, is the so-called Desert or Western Lime (*Eremocitrus glauca*).

FAMILY ANACARDIACEÆ.

A family of trees or shrubs. Leaves mostly alternate, simple or compound. Flowers unisexual or hermaphrodite. Petals 3-7, sometimes absent. Stamens the same number as or twice the number of petals, rarely indefinite or reduced to one fertile, the remainder small and abortive. Ovary one to several celled. Fruit superior or semi-superior, usually a fleshy drupe, or in one or two genera dry or nearly dry and seated on a fleshy and much enlarged fruit-stalk or pedicel.

The family finds its greatest development in the tropics. It is represented in Queensland by seven native species. These include the Burdekin Plum (*Pleiogynium Solandri*), the Tar Tree (*Semecarpus australiensis*), Deep Yellowwood (*Rhodosphaera rhodanthema*), and North Queensland Bolly Gum (*Blepharocarya involucrigera*). Many of the species possess a blistering sap, as the Tar Tree and the North Queensland Bolly Gum. One of the worst offenders in this respect is the Poison Ivy (*Rhus toxicodendron*), an ornamental climber only rarely seen in Queensland gardens. This vine colours well in autumn in colder places, but, as many people are affected very badly by contact with it, it is unwise to plant it, especially as other vines are available. In plants causing skin irritation individual idiosyncracy enters largely into the degree of infection.

Of cultivated fruits the most important is the Mango (*Mangifera indica*), a native of India cultivated throughout the tropics and subtropics of the world. The Cashew Nut of the West Indies and tropical America is *Anacardium occidentale.* The pericarp contains a blistering, resinous, poisonous sap, but the kernel is edible, as is also the enlarged fruit stalk on which the fruit is seated.

FAMILY SAPINDACEÆ.

A family of trees, shrubs, or climbers, the climbing members sometimes herbaceous. Leaves alternate, mostly compound. Flowers unisexual or rarely hermaphrodite. Sepals 4 or 5, free or united into a toothed or lobed calyx. Petals as many as the sepals or calyx lobes, sometimes one less in number, and at times minute or entirely absent, frequently bearing scales on the inner face. Stamens usually 8. Ovary superior, most commonly 3-celled. Fruit a capsule. Seeds usually with an arillus, which is sometimes showy and sometimes pulpy and edible.

The family is a large one, finding its greatest development in the tropics. It is well represented in the Queensland flora, particularly among the smaller or medium-sized trees of the rain-forests or jungles of the coastal belt. One of the most widely distributed native species is the Boonaree or Western Rosewood (*Heterodendron oleæfolium*), frequently cut as fodder during times of drought. It develops at times a prussic-acid-yielding glucoside, and on this account hungry stock should not be allowed to feed too heavily on the freshly cut foliage. Among the commonest forest shrubs are the various species of *Dodonæa*, generally known as Hop Bushes. Their dry, winged seed-capsules have been used as a substitute for hops. The bark, leaves, and pods of several *Sapindaceæ* possess a saponin, and for a short time a small industry was worked up in the collection of the bark of *Jagera pseudorhus*, a handsome native tree familiarly known as Foam Bark, as a substitute for Quillaja bark, imported for heading ales and stouts; the rather erratic distribution of the tree, however, prevented the continuance of the work. Quillaja bark itself is the product of *Quillaja saponaria*, a native of South America, and a member of the family *Rosaceæ*.

A feature of the seeds of several *Sapindaceæ* is the development of a large, fleshy aril (see page 385, plate 175), often of an acid or agreeable distinctive flavour. The best known is the Litchi (*Litchi chinensis*). Others less frequently seen away from the eastern tropics are the Rambutan (*Nephelium lappaceum*) and the Longan (*Euphoria Longana*). The seeds of the native Tamarinds (*Diploglottis* and *Arytera*) possess a very acid, watery pulp.

FAMILY VITACEÆ (GRAPE VINE FAMILY).

A family of woody climbers or rarely erect shrubs, stems often articulate (*i.e.*, easily broken or detached) at the nodes. Leaves alternate. Flowers small in racemes, panicles, or cymes opposite the leaves. Peduncles (or inflorescences?) often metamorphosed into tendrils. Calyx small, entire or 4-5-toothed or lobed. Petals 4-8. Stamens 4-5 opposite the petals. Ovary usually immersed in or surrounded by the disk. Fruit a berry, often with a watery pulp.

The family is a large one widely spread over the tropical and warm temperate regions of the world. It is represented by about twenty native species, one of which (*Leea sambucina*), is a large, straggling shrub common in shrubby hillsides near the sea. Some of the native species, both in the stems and leaves and fruits, contain needles of calcium oxalate, and cause considerable irritation when bitten or chewed. The common European grape is *Vitis vinifera*. The genus *Vitis* is particularly well developed in North America; the species which has been most improved is *Vitis labrusca*, which has also been hybridised to some extent with *V. vinifera*. Other American species that have been used for improvement and hybridisation are *V. æstivalis* and *V. rotundifolia* (Muscadine). A feature of American grapes is their resistance to phylloxera, which makes them of importance as stocks in many grape-growing areas.

FAMILY ROSACEÆ (ROSE FAMILY).

A family of trees, shrubs, or herbs. Leaves simple or compound, alternate. Flowers usually hermaphrodite. Calyx mostly enclosing the ovary. Lobes 5. Petals 5. Stamens from twice as many as the petals to indefinite. Ovary of one to many carpels. Fruit various, frequently a drupe, as in the "stone" fruits—Peach, Plum, &c. The pome characteristic of "pomaceous" fruits—Apple, Pear, Quince, &c.—is formed from the enlargement of the torus or floral receptacle (see page 370), the carpels being embedded in the middle, each surrounded by its thin bony or leathery pericarp. The "hip" of the rose is composed of the hollowed and enlarged floral receptacle enclosing in this case a number of achenes (the true fruits). In the Strawberry (*Fragaria*) the floral receptacle enlarges and becomes fleshy after fertilization, the true fruit being the achenes embedded near the surface. The Blackberry, Raspberry, Loganberry, &c. (genus *Rubus*), possess flowers somewhat similar in structure to those of the Strawberry, but the floral receptacle, instead of becoming enlarged and fleshy, remains comparatively small; the carpels themselves, however, develop into small, succulent drupes (sometimes called "drupels").

Fruits such as the Apple, Rose hip, Strawberry, &c., in which parts other than the ovary itself go to form the fruit, are often termed false fruits. Other examples are the Fig, Pineapple, and Mulberry (see page 381). The Blackberry, Raspberry, &c., represent true fruits, as the parts which give succulence to the fruits is the fleshy pericarp of each little drupe or drupel.

The family *Rosaceæ* is a very large one widely spread over the world, but finding its greatest development in temperate regions. It includes many fruits, as the Apple (*Pyrus Malus*), Pear (*Pyrus communis*), Plum (*Prunus domestice*), Cherry (*Prunus cerasus*), Peach (*Prunus persica*), Almond (*Prunus amygdalus*), Quince (*Cydonia vulgaris*), Loquat (*Eriobotrya japonica*), Strawberry (*Fragaria vesca*), Blackberry (*Rubus fruticosus*), &c.

The family contains many of the common garden shrubs cultivated in Queensland—*e.g.*, Hawthorn (*Cratægus*), May (*Spiræa*), Indian Hawthorn (*Raphiolepsis*), *Photinia*, Rose (*Rosa*), &c.

It is poorly represented in Australia, the native Queensland members consisting of two trees—the Nonda Tree (*Parinarium Nonda*) and *Pygeum Turnerianum*, both of North Queensland, five species of *Rubus* (Native Raspberries or brambles), and two species of *Acæna* (Sheepburrs).

FAMILY LEGUMINOSÆ (THE LEGUMES).

The family *Leguminosæ* is characterised mostly by the fruit being a typical legume (see page 378). The plants composing it may be trees, shrubs, or herbs; the leaves vary from simple to bipinnate; the flowers regular to irregular (see pages 372-3); the petals are free or may be partly united; stamens few or many, free or variously united; the carpels are superior, and, except in one or two genera, are solitary; the fruit is a legume; the cotyledons are large and the seeds without endosperm. A feature of legumes is the development of bacterial root nodules. These bacteria that are present in the soil, and are particularly abundant in soils that have previously carried a leguminous crop, enter the tissues through the root-bark and set up the formation of the characteristic galls or nodules. By means of this bacterial association the plant is enabled to obtain nitrogen from the air, other plants not so affected having to rely for their supply of nitrogen upon nitrates and ammonia salts in the soil.

The family is of world-wide distribution. It is divided into three well-marked sub-families regarded by Hutchinson, the English botanist, in a recent work, as three distinct families:—

(1) *Mimosoideæ* (family *Mimosaceæ*);

(2) *Cæsalpinioideæ* (family *Cæsalpiniaceæ*);

(3) *Papilionatæ* (family *Papilionaceæ* or *Fabaceæ*).*

In the *Mimosoideæ* the leaves are mostly bipinnate, rarely simply pinnate, and in one genus (*Acacia*) reduced mostly in the adult plants to phyllodes (see page 228). The flowers are regular; petals valvate in the bud—often small; stamens as many as the petals, twice as many or indefinite, free or monadelphous.

In the sub-family *Cæsalpinoideæ* the leaves are bipinnate, simply pinnate, or rarely simple. The flowers are irregular or rarely regular; petals imbricate in the bud, the upper one never outside and usually quite inside, or in a few genera some or even all four of the lower petals wanting. Stamens usually 10, sometimes few, rarely indefinite, free or more or less united.

In the sub-family *Papilionatæ* the leaves are simple or simply pinnate; the flowers are very irregular; the petals are imbricate in the bud, the upper one on the outside. In this sub-family the upper and outer petal is called the standard or vexillum, the two side petals the wings, or alae, and the two lowermost petals form the keel or carina. Stamens usually 10, all free, monadelphous or diadelphous.

The indigenous flowering plants of Australia number approximately 10,000 species. The family *Leguminosæ* is numerically the largest family, containing approximately 1,100 species.

In the sub-family *Mimosoideæ* the most important genus is *Acacia*, which contains about 500 species widely spread over the tropics and sub-tropics of the world, and finding its greatest development in Australia, between 350 and 400 species occurring here. It is the largest genus of Australian flowering plants.

The Australian species belong to two groups—

(1) *Phyllodineæ,* in which the leaf function is performed by phyllodes, the true leaves dropping off at an early stage in the plant's development;

(2) *Bipinnatæ,* in which the leaves are all pinnate.

The first is by far the greater in Australia. The group is almost entirely Australian, only a very few being found elsewhere. A few are found in the Western Pacific, and one (*Acacia mangium*), common in North Australia, extends northward to the Malay Archipelago. One species (*Acacia Koa*—the source of the famous Koa wood) is a native of the Hawaiian Islands. A discussion on the development of the *Acacia* phyllode will be found on page 228.

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* The usual practice is to base the name of the family on the first named genus in it. This is usually deviated from in certain families, such as the *Leguminosæ*, the *Umbelliferæ*, and the *Compositæ*, though even here some botanists prefer to use the names *Fabaceæ*, based on *Faba*, the Broad Bean, *Ammiaceæ*, based on *Ammi*, the Bishop's Weed, and *Asteraceæ*, based on *Aster*, respectively, for these three families.

One of the main features of Australian wattles from an economic standpoint is the importance of the bark of several species as a source of tannin. Australia, in the barks of its indigenous wattles, possesses one of the richest, if not the richest, source of tannin in the world. The use of wattle bark is on the increase, and in England the bark and the tan extract, along with other extracts, are largely taking the place of older tanning substances, such as oak bark, which were previously used.

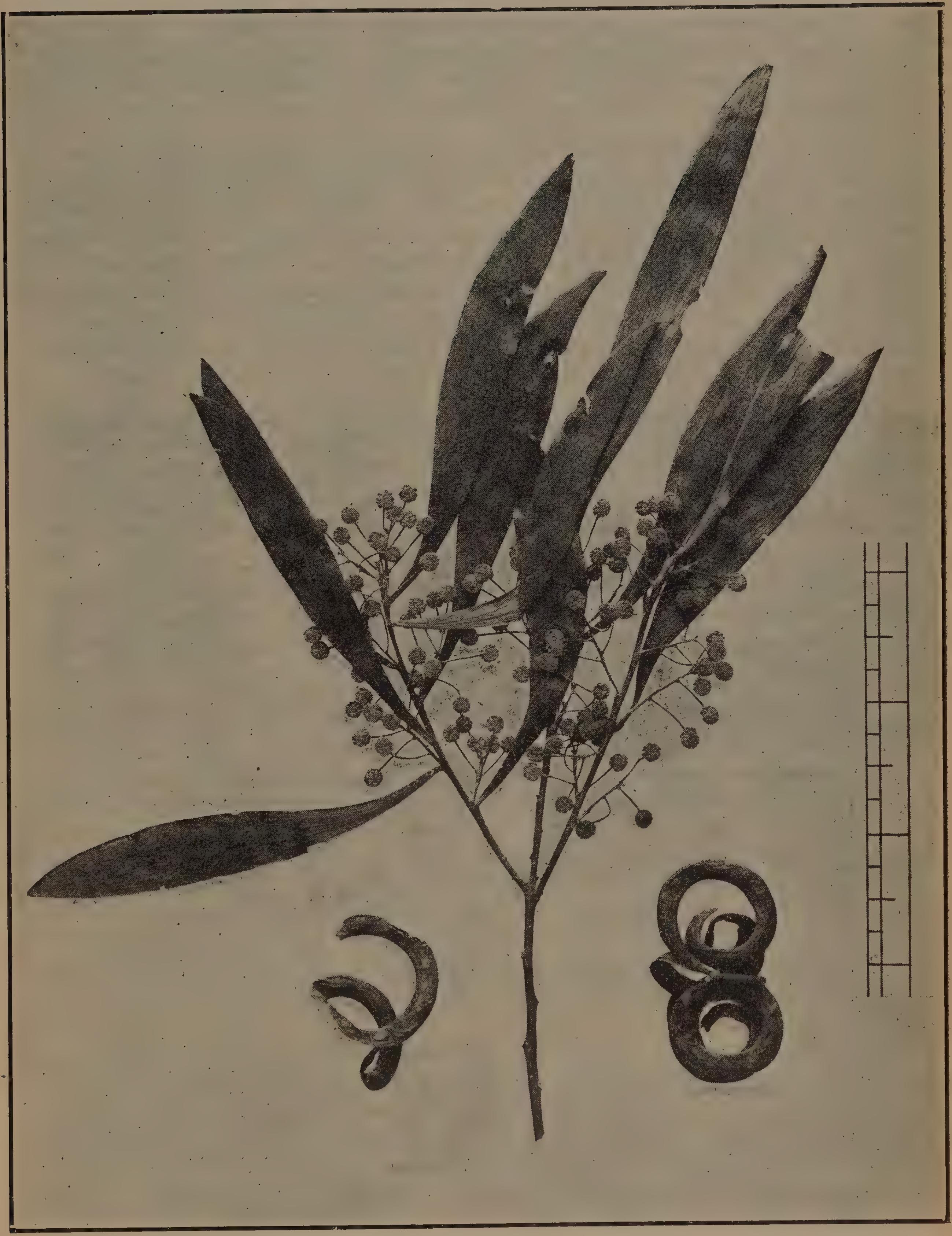

Plate 7.

BROAD-LEAVED SALLY WATTLE (*Acacia implexa*).—A common tree in coastal Queensland. It is a member of the Sub-family Mimosoideæ of the Leguminosæ.

The wattle yielding bark richest in tannin is the Golden Wattle of South Australia (*Acacia pycnantha*), commonly known in commerce as "pycnantha wattle." It is a native of South Australia, Victoria, and New South Wales. It has been introduced into Queensland at various times, but is not particularly suited for cultivation here on an extensive scale. It is mostly a shrubby species 12 to 14 feet high and a few inches in diameter. The next richest wattles in tannin content, but still more important from the actual amount of wattle bark used at the present time are the *Acacias* or wattles of the *decurrens* groups—*i.e., Acacia decurrens* and its varieties and allied species. The most important of these is *Acacia mollissima* (syn. *A. decurrens* var. *mollissima*), which occurs in all the Eastern States, including Tasmania. It is very rare in Queensland, but in Tasmania is the only form.

In speaking of tan barks, Mr. A. R. Penfold, Curator, Technological Museum, Sydney, stated recently in an address before the Royal Society of New South Wales that unfortunately the story of the wattle-bark industry is a very sad one for Australia. About fifty years ago South Africa established wattle-bark plantations from seed collected in Australia. To-day 300,000 acres are under plantation in that colony. Tan bark and tannin extract to the value of £1,000,000 are exported annually. Mine props bring in an additional £500,000 per annum, and wattle cultivation ranks fourth in the Union's agricultural industry.

The treeless, grassy highlands of Natal are specially suitable for wattle culture, and the tree can, therefore, be grown in rows and economically tended to, while the necessary bark sheds and appurtenances can be placed in the most advantageous position. Moreover, there is an abundance of cheap and efficient native labour available for employment on the plantations.

Although there is an import duty of £3 per ton, it does not seem to have afforded very great encouragement for the cultivation of the wattle in Australia. The prevailing rate of exchange has greatly assisted the industry during the past ten years.

The total production of tan barks in Australia is estimated at 27,000 tons.

The cultivation of wattle for the production of bark cannot be too strongly recommended, and, unless early steps are taken to retrieve the position, it looks as if the industry has passed to South Africa for all time. The South Africans have been studying the position very thoroughly, so much so that they are now planting from selected trees. It has been found that certain trees have thicker bark than others, and, as it has been shown that the thicker the bark the greater the concentration of tannin, it is perfectly obvious that it is only a matter of time when their plantations will consist solely of these selected trees very rich in tannin.

The timber of the wattles is, as a rule, hard and heavy, but very beautiful. The species producing the timber of the greatest value is *Acacia melanoxylon,* Blackwood, one of the most important cabinet woods in Australia. The majority of the species are natives of the open forest or interior parts, but a few occur in the coastal rain-forests. One of these is *Acacia Bakeri,* the Marble Wood, a light-coloured timber with a beautiful grain. It is now being used to a limited extent in railway carriage work. Some of the species occur on rain-forest edges very abundantly, sometimes almost as pure stands as secondary growth after the forest or scrub has been cleared. Some of the species are gregarious, particularly in the interior parts, forming particular types of scrub, such as the Brigalow, Lancewood, Mulga, Gidgee or Gidyea, Yarran, and Bendee scrubs of Western and Northern Queensland. Boree (*Acacia homatophylla*) occurs sometimes as pure stands, but more often as individual trees or scattered clumps.

The majority of wattles are small trees, only a few producing mill logs; the woods of some, however, on account of their distinctive beauty, are in demand for the manufacture of small fancy articles. Some of the woods now used extensively are Mulga (*Acacia aneura*), Bendee (*Acacia* sp., perhaps a form of *A. aneura*), and Myall (*Acacia pendula*).

Albizzia is a genus of about fifty species widely spread over the tropics. It is closely allied to the bipinnate Acacias, but differs in the petals being united in the lower part. Of the six Australian species, one is found in Western Australia, the others in Queensland. The tree colloquially known as ''Acacia'' in the Queensland sugar-belt is a species of *Albizzia* (*A. procera*). Another species extensively planted in the Central-West and familiarly known as ''Acacia'' is *A. Lebbek,* a native of India.

Erythrophlœum Laboucheri, Red Ironwood or Poisonous Ironwood of North Queensland, is a tree of about 50 feet high with exceptionally hard, heavy wood. The leaves are extremely poisonous, and cause a good deal of trouble at times on this account among stock in North Queensland and the Northern Territory.

The sub-family *Cæsalpinioideæ* is not very well represented in the native flora. The largest genus is *Cassia,* some of the members of which are cultivated as garden trees and shrubs. Several are native and others are naturalised weeds. *C. fistula,* the Indian Laburnum, is very common in Queensland gardens, particularly in the coastal North. The long, cylindrical pods are familiarly known as Cascara Beans, and the sweetish pulp that surrounds the seeds is a mild purgative. It has no relation to the true Cascara of commerce, which is obtained from the bark of a North American tree (*Rhamnus Purshiana*). *Cassias,* on the whole, possess purgative properties, and the dried leaves of several are the familiar Senna leaves of commerce.

The genus *Bauhinia* is represented by several native species, very shapely trees, mostly natives of the inland parts of the State, and several rather showy, flowering, cultivated ones.

Belonging to this sub-family is the Tamarind (*Tamarindus indica*), a native of India extensively cultivated in North Queensland. Tamarind pulp is imported for use in the manufacture of sauces such as Worcestershire sauce.

Papilionateæ is a large sub-family represented in Australia by a number of plants found nowhere else, and many of which are among the brightest of our native flowering shrubs. Few of them reach tree size.

Castanospermum is a genus of several species containing the Bean Tree or Moreton Bay Chestnut (*C. australe*), a native of the rain-forests or vine scrubs of coastal Queensland and New South Wales. In more open country it is common along river and creek banks, usually associated with River Oak, River Tea-tree, and other typical riverside trees.

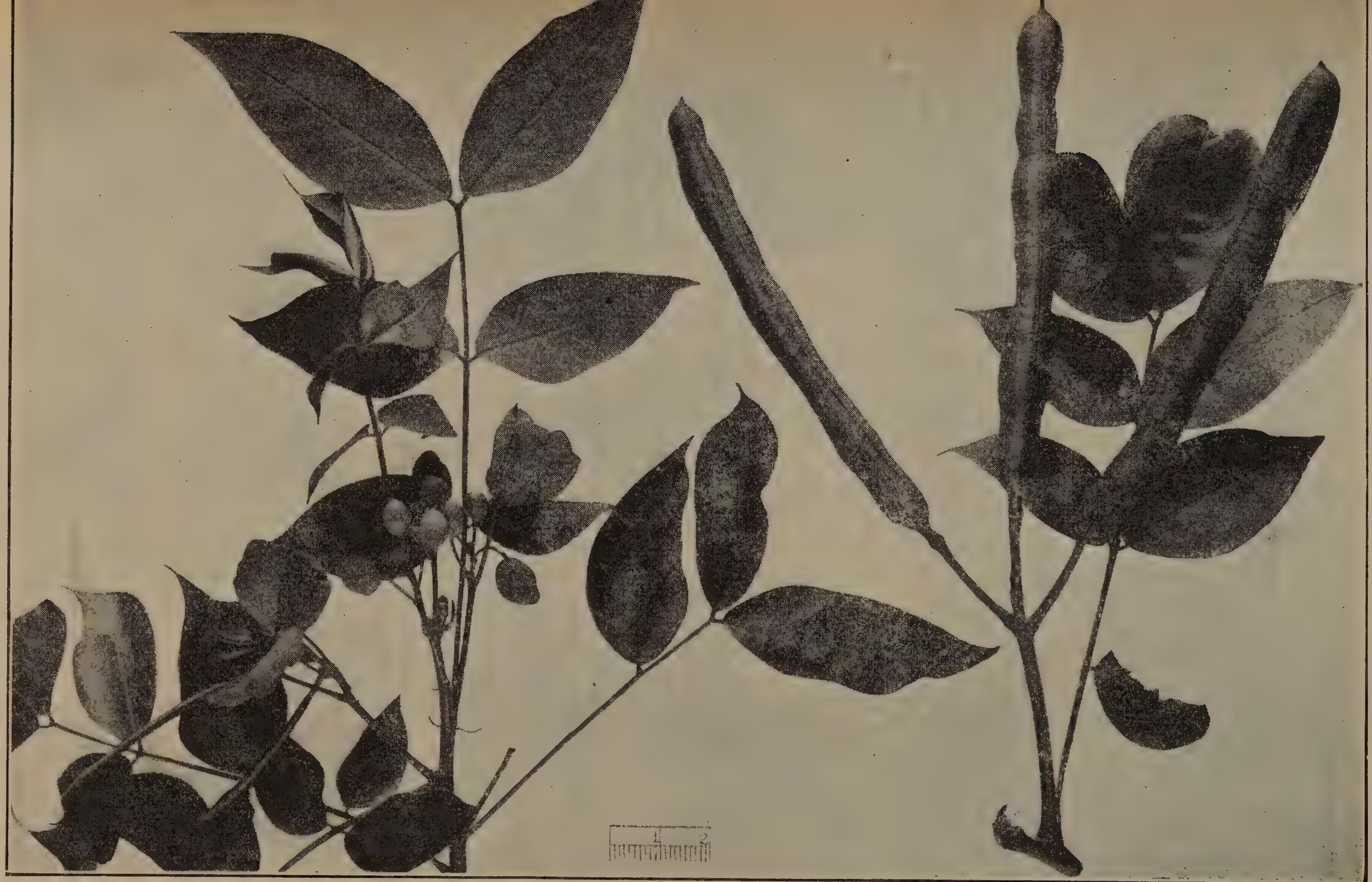

Plate 8.

ARSENIC BUSH (*Cassia laevigata*).—A native of tropical America now a common naturalised weed in most warm countries. It is a member of the Sub-family Cæsalpinioideæ of the Leguminosæ.

The timber is one of the most handsome of our cabinet woods, but, owing to its wide sapwood and the faulty nature of the large trees, it is rather less widely used than it might otherwise be. The seeds are poisonous to stock, causing severe gastro-enteritis. The sub-family contains some important vegetables, such as the Pea (*Pisum sativum*), French Bean (*Phaseolus vulgaris*), Lima Bean (*P. lunatus*), Soy Bean (*Glycine hispida*), Cowpea (*Vigna catjang*), Peanut (*Arachis hypogœa*), Broad Bean (*Faba vulgaris*), and the Lentil (*Lens esculentus*).

The genus also includes many valuable pasture plants, such as the clovers and trefoils, and numerous native herbs.

FAMILY MYRTACEÆ (THE MYRTLES).

Myrtaceœ is a very large family of trees and shrubs with fairly constant characters. The leaves are always simple, with an entire margin, and, examined under a lens through transmitted light, are seen to be pellucid-dotted. The flowers are hermaphrodite; the calyx-tube is usually more or less joined to the ovary; the lobes 3 or more; petals 4-6; stamens from the same number as the petals to very numerous. The ovary is usually inferior, but in a few species is half-superior or almost wholly superior. The fruit is a dry capsule or a one or several seeded berry. It is on this nature of the fruit that the family is divided into two sub-families, viz., sub-family *Leptospermoideœ* (capsular or dry-fruited forms) and sub-family *Mytoideœ* (berry-fruited forms).

The family contains nearly 3,000 species widely spread over the world, but finding its greatest development in tropical and sub-tropical countries. It is represented in Australia by nearly 1,000 species, and is numerically the second largest family of Australian flowering plants, the largest being Leguminosæ with approximately 1,100 species.

The most important genus economically in Australia and probably in the world is *Eucalyptus*. The Eucalypts of Australia, according to the latest monograph by W. F. Blakely, the leading authority on the genus, number a little over 600 species.

The Eucalypts comprise a very natural group with special botanical characteristics. The leaves of most species are dimorphic—*i.e.*, of two distinct types—(*a*) the leaves which occur on young trees and stump shoots, usually referred to as "sucker" leaves, though coppice leaves, I think, is a more correct term (Maiden, Blakely, and several other botanists refer to them as juvenile leaves); and (*b*) the leaves in the adult tree, usually referred to as secondary or adult leaves. The former often differ markedly from the adult forms, sometimes being much larger, sometimes much narrower, and less frequently show little differences from them. They are sometimes opposite and horizontally placed and supposed to represent the original type of Eucalyptus leaf, the vertically placed leaves on the older tree having arisen in response to the dry conditions that gradually became more prevalent in a good many parts of Australia.

Eucalyptus is very distinct in its floral character. The flowers are apetalous, and the calyx lobes are welded together into a small lid or operculum which covers the essential parts of the flower in their young stages and falls off and exposes them on maturity. In one species common in Queensland—namely, the Spotted Gum (*Eucalyptus maculata*)—the operculum is double, the inner operculum being of fine

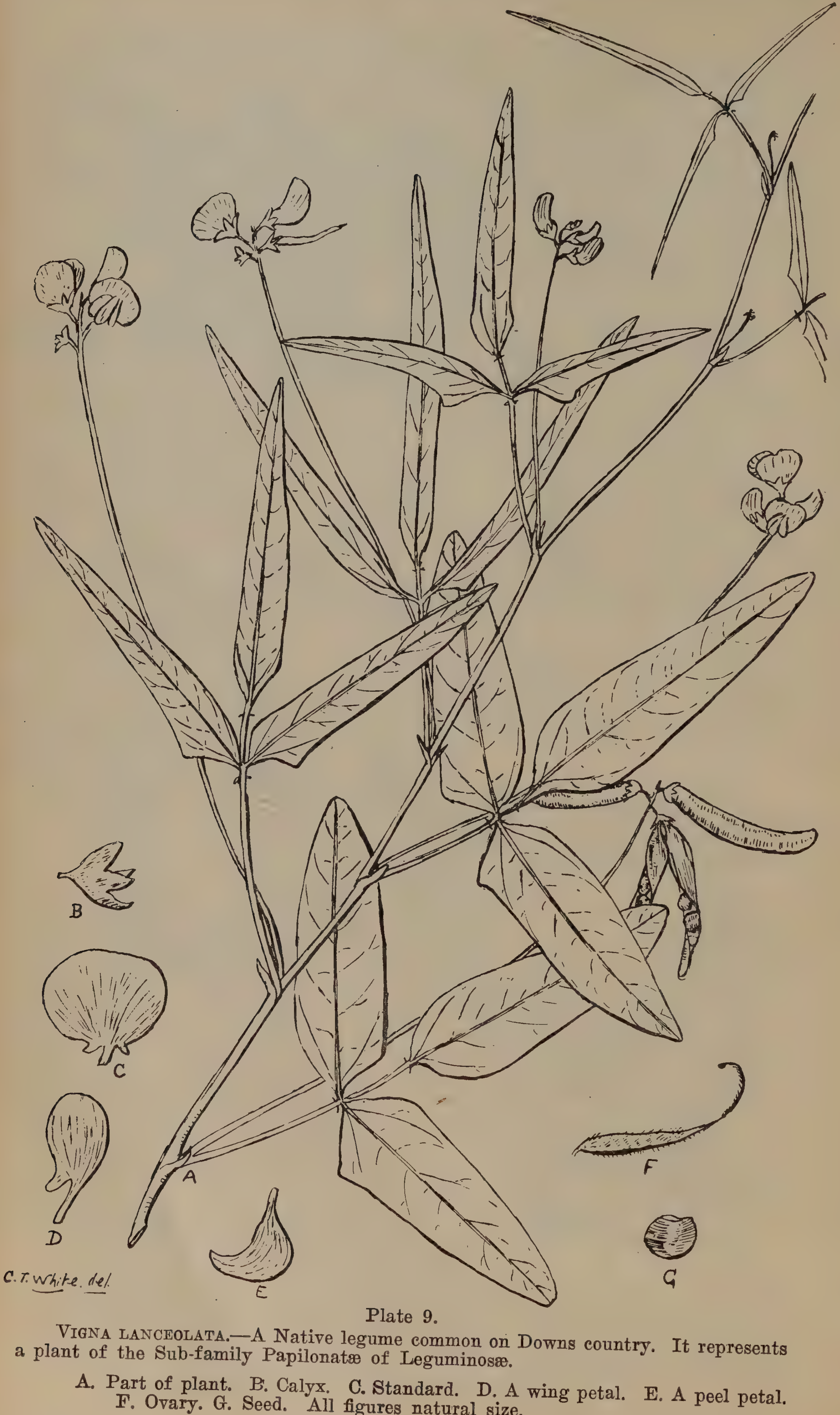

Plate 9.

VIGNA LANCEOLATA.—A Native legume common on Downs country. It represents a plant of the Sub-family Papilonatæ of Leguminosæ.

A. Part of plant. B. Calyx. C. Standard. D. A wing petal. E. A peel petal. F. Ovary. G. Seed. All figures natural size.

texture, and possibly representing a corolla. The ovary and calyx tube in which it is borne are welded together, and eventually develop into the capsule. The number of cells in the capsule varies from three to seven, and when ripe each cell opens at the top by a small valve.

The outstanding economic feature of the genus is the value of its timbers, Eucalyptus being the most important genus of hardwood trees in the world. On this account they have been largely planted in all warm and sub-tropical countries.

The extraction of the oil from the leaves is a very important industry in the Southern States, particularly Victoria and South-Eastern New South Wales. The industry has never assumed very large proportions in Queensland, probably due to the fact that the principal use of the oils is in pharmacy, and the cineol or eucalyptol content of the oils of our commoner species does not come up to the standards required by the British and United States Pharmacopœias, which set the standards at 55 per cent. and 70 per cent., respectively. This is very arbitrary, as it is not at all certain that cineol is the most important germicidal constituent in eucalyptus oils.

An important direction in which eucalyptus oils are employed is in perfumery for scenting soaps, barbers' requisites, &c. The most important species in this connection are those with a strong citron or lemon-scented oil, of which *Eucalyptus citriodora* (*E. maculata* var. *citriodora*) is the most important commercially. It is a remarkable fact that most of the Eucalypts and allied plants yielding citron or lemon-scented oils that occur in Australia are found in Queensland—for instance, Citron-scented Spotted Gum (*E. maculata* var. *citriodora*), the Lemon-scented Ironbark (*E. Staigeriana*), the Citron-scented Tea-trees (*Leptospermum citratum* and *L. Liversidgei*), and the Backhousia (*Backhousia citriodora*).

The name "gum-tree," as applied to Eucalypts generally originated from the amount of dark, gumlike matter that exudes from the tree or is found in cracks in the timber. On exposure to the air it becomes dry and brittle. Such plant juices are known technically as kinos. They are generally impregnated with dark colouring matters, and are used in medicine and in the dyeing and tanning industries.

Though the Eucalypts in themselves form a very natural genus of plants, many difficulties are presented in any attempt to arrange the species into natural groups possessing a number of characteristics in common. There have been various schemes of classification proposed by different botanists from time to time, each scheme being based primarily on one particular feature, such as barks, anthers, fruits, chemical constituents, &c. It necessarily means, however, that such schemes of classification are to a very large extent artificial, trees naturally closely allied being placed wide apart in the arrangement of the genus. The scheme of classification adopted by most botanists and followed by W. F. Blakely in his "Key to the Eucalypts" is based on anther characters, and was originally propounded by Bentham in the "Flora Australiensis." This is a system that, personally, I have found rather difficult to follow.

For field work, as far as Queensland species are concerned, the bark characters are the most serviceable upon which to group the species. Classification of the genus on the bark was first proposed by Baron von Mueller and later elaborated by J. H. Maiden.

The Queensland species can be divided up into five groups—(1) Smooth-barked Trees or Gums proper, (2) Boxes, (3) Stringybarks, (4) Ironbarks, (5) Bloodwoods. To these we can add a further group —the Mallees and Marlocks—based on habit, and not on bark characters.

In the first group (the Smooth-bark Trees or Gums) the trunk is normally smooth, the bark coming off in scales or strips, leaving a clean, smooth barrel; the bark is commonly persistent at the base of the trunk. In this group are included the various Blue Gums, Grey Gums, Red Gums, White Gums, &c. Among the representative species are the Queensland Blue Gum or Forest Red Gum (New South Wales) (*E. tereticornis*), Flooded Gums (*E. saligna* and *E. grandis*), Grey Gums (*E. propinqua* and *E. punctata*). Scribbly Gum (*E. micrantha*), the River Red Gum (*E. rostrata*), &c.

The second group (Boxes) are characterised by having a dark-grey bark, more or less fibrous and much interlocked. The common and most widely distributed group of this species in Queensland is the Bimbil Box (*E. populifolia*). Another species very common is Gum-topped Box (*E. hemiphloia*), characterised by having typical box bark on the trunk, branches and branchlets smooth, and the shed bark often hanging down in long ribbons from the forks. The various bark groups run into one another—*e.g.*, it is hard to know whether the Yellow Box of the Darling Downs (*E. melliodora*) should be placed in the Boxes or Gums proper.

The third group (Stringybarks) possess a very fibrous bark, ageing to grey and often more or less blackened by fire. Representative species are Red Stringybark (*E. resinifera*), Yellow Stringybark (*E. acmenioides*), with its variety *carnea* and allied species *E. umbra,* White Stringybark (*E. eugenioides*), &c. This is an ill-defined group, and includes the Tallowwood (*E. microcorys*), the Rough Stringybark (*E. Baileyana*), and some others with not particularly fibrous barks.

The fourth group (Ironbarks) are trees with a hard, furrowed, black or dark-grey, persistent bark, rather friable, and the cracks often carrying a dark-red kino or "gum." Representative species are Silver-leaved Ironbark (*E. melanophloia*), Broad-leaved Ironbark (*E. siderophloia*), Grey Ironbark (*E. paniculata*), Narrow-leaved Ironbark (*E. crebra*), and Red Ironbark or Mugga (*E. sideroxylon*).

The fifth group (Bloodwoods) possesses a persistent bark, commonly inclined to be spongy and friable, and roughly and irregularly tessellated; outer layers lemellar, inner layers rather fibrous. This group includes the common Red Bloodwood (*E. corymbosa*), Western Bloodwood (*E. terminalis*), the White Bloodwood (*E. trachyphloia*), the Northern Bloodwood (*E. dichromophloia*), and a number of trees known in Western and Northern Queensland as Yellow Jackets (*E. Bloxsomei, E. peltata,* and others).

The sixth group, comprising the Marlocks and Mallees, is very poorly represented in Queensland, but is well developed in the Southern States and Western Australia. Mallees are of a shrubby growth and typically have a large, woody stock from which arises a number of stems all about the same height and thickness. They are frequently gregarious, and occur in the form of Mallee scrubs. Much Mallee scrub has been cleared for farming purposes, particularly wheatgrowing, in Victoria. Marlocks are not represented in Queensland, but are fairly common in Western Australia, and are distinguished from Mallees in having a much reduced woody stock and only a single stem. They are common on the sand plain country of Western Australia, but it is difficult sometimes to distinguish between the two groups.

Several other genera of Myrtaceæ, though unimportant as timber trees compared with *Eucalyptus,* are very common in the open forests, and some in the rain-forests or jungles of the State.

Angophora is closely allied to Eucalyptus, differing principally in the presence of petals in the flower. The two commonest and most widely spread are those trees known as Apple Trees (*A. subvelutina* and *A. intermedia*).

Tristania is also allied to Eucalyptus, but the leaves are mostly broader and horizontally placed. It is distinguished principally from both *Angophora* and *Eucalyptus* in the stamens, which are united into five bundles. Important species are the Swamp Mahogany (*T. suaveolens*) and Brush Box (*T. conferta*).

Syncarpia is characterised by the flowers being in heads. Three species occur in Queensland. The commonest and best known is *S. laurifolia,* the common Turpentine, which extends from a little south of Sydney, in New South Wales, to some distance north of Cairns, North Queensland.

Xanthostemon is a genus of few species scattered throughout the Malay Archipelago, New Guinea, and Australia. Several are found in Queensland, and most of them are known as Penda. The most important is *X. pubescens,* the Red Penda or Atherton Penda, used for house-framing and flooring under cover. Exposed to the weather its life is comparatively short, varying from five to ten years. The characteristic feature of the genus botanically is the presence of a half-superior or almost wholly superior ovary—an unusual condition in *Myrtaceæ.*

Melaleuca is a widely spread genus in the Malayan Archipelago, Australia, and New Caledonia, but finding by far its greatest development in Australia. Species of *Melaleuca* are usually called Tea-trees in Queensland, though in the Southern and Western States the vernacular is also applied to several trees and shrubs of allied genera. The name Tea-tree is due to the fact that Dr. Anderson, who was the surgeon and naturalist on Cook's third voyage, mistook a species of *Leptospermum* for a North American plant which was then being used as a substitute for ordinary tea. Cook used the leaves of the Australian plant, and the beverage was found, though only moderately palatable, quite useful for keeping down scurvy. The spelling ''Ti'' should not be adopted.

Of recent years at least two species of *Melaleuca—M. alternifolia* and *M. linarifolia*—have come prominently into notice, due to the high germicidal value of their essential oils.

The fleshy-fruited *Myrtaceæ* are mostly found in the rain-forests and along creeks and rivers. The largest genus is *Eugenia,* which includes the common Lillipilli (*E. Smithii*) and the Creek Cherry (*E. paniculata*). Several of the *Eugenias* attain the size of very large trees, and are known as Water Gums. One of these (*E. gustavoides*) is one of the principal building timbers of the Atherton Tableland. The name ''Water Gum'' is one rather loosely used in Queensland for a number of Myrtaceous trees, being applied to species of *Tristania* and *Agonis.*

A fruit of an evil reputation in North Queensland is the Finger Cherry (*Rhodomyrtus macrocarpa*), reputed to have caused blindness on occasions to persons who have eaten freely of them. At other times fruits seem to have been eaten without any ill-effects following.

Of other genera of *Myrtaceæ*, very few are of interest to the farmer and pastoralist. Some contain edible fruits, the principal genus being *Psidium,* which includes the Guavas. The two commonest in cultivation in Queensland are the common Guava (*P. guajava*) and the Cherry Guava (*P. cattleianum*). Both are natives of tropical America. The former has become quite naturalised in many tropical and sub-tropical countries, including much of coastal Queensland.

Allied to the Guavas is the *Feijoa* (*Feijoa Sellowiana*), a native of the Argentine; it grows well in Queensland, but fruits well only in the cooler parts of the State, such as about Toowoomba, &c. On the coast conditions do not seem to suit it, and, though it grows well enough, ripe fruit are rarely set.

The genus *Eugenia,* already referred to, includes some important fruits. The commonest in Queensland is the Brazilian Cherry (*E. uniflora*). Others less frequently seen are the Rose Apple (*E. jambos*) and the Malay Apple (*E. malaccensis*).

FAMILY UMBELLIFERÆ.

A family of herbs, often aromatic, occasionally with a tendency to be slightly woody or shrubby. Leaves alternate, often much cut and divided; the petiole or leaf-stalk usually dilated into a sheathing base. Flowers in simple or compound umbels. Calyx tube adnate to the ovary, the limb forming a rim around the summit, or 5-toothed or quite inconspicuous. Petals 5. Stamens 5. Ovary inferior, 2-celled. Styles 2. Fruit usually separating into two 1-seeded nuts or carpels called mericarps, leaving a persistent central axis—the carpophore (see Plate 170).

The family is a large one widely spread over the world, but finding its greatest development in temperate regions. It includes a number of vegetables and herbs, as the Celery (*Apium graveolens*), Carrot (*Daucus carota*), Parsnip (*Peucedanum sativum*), &c. The Fennel (*Fœniculum vulgare*) is a common farm weed in Queensland, particularly on the Darling Downs. The native species are few in number; a couple—*e.g.*, *Apium leptophyllum* and *Daucus brachiatus*—are common farm and pasture weeds. They mostly have very insignificant flowers, an exception being the genus *Actinotus* (which includes the Flannel Flower (*A. Helianthi*)) and its allies; their showy character is due to an involucre of woolly bracts (see Plate 155).

[TO BE CONCLUDED.]

Cheese Starters.

E. B. RICE, Dairy Research Laboratory.

THE need for vigorous starters for the manufacture of cheese is now appreciated by all cheesemakers, but there is a lack of knowledge of the scientific principles pertaining to their propagation and functions. It is hoped that this paper will serve to enlighten cheesemakers upon some of the more important aspects of the problem.

Definition.

A cheese starter is a culture of living micro-organisms which is used for the purpose of bringing about certain changes during the manufacture or ripening of the cheese. Different species of micro-organisms are used for different purposes in the manufacture of the many varieties of cheese; such as moulds for the blue-veined cheeses, propionic acid bacteria for ensuring eye-formation in Gruyere cheese, and for the purpose of cheddar cheese manufacture, which is almost the only variety produced in quantity in Queensland, lactic acid bacteria are propagated in milk and added to the milk in the vat.

Classification of Starters.

Starters may be broadly grouped as follows:—

1. Natural.
2. Commercial.

Natural Starters.—The usual procedure followed in the preparation of a natural starter is to choose the milk from some dairyman who is known to take special care in its production and allow the selected milk to sour spontaneously. Starters prepared in this manner have been discarded in most of the leading dairying countries, as their use can only be attended with results that are uncertain. The preparation of starter cultures is now confined to laboratories which specialise in the work.

Commercial Starters.—These are supplied in powder or liquid form, or on what is known as an agar slant. Directions are usually furnished by the laboratory from which they are obtained as to the manner in which large numbers of actively growing organisms are to be built up from the culture. Such instructions should be strictly adhered to. Milk is the usual medium for the propagation of the starter in a factory. Too much emphasis cannot be stressed upon the necessity for using only the best quality milk and observing the utmost care and cleanliness in all operations connected with starter making.

It was the custom formerly to include other bacteria besides the lactic acid bacteria in the starters for cheddar cheese, and these bacteria are still included in the starters supplied by some commercial laboratories. Experience has, however, indicated that although these associated bacteria are desirable in starters for butter manufacture (starter-ripened butter is seldom made in Queensland owing to its inferior keeping quality), their presence is not required in a cheese culture. The particular species of bacterium contained in the starters which are now being supplied by the Dairy Research Laboratory is known as *Streptococcus cremoris,* strains of which are used in starters produced by all the leading dairying institutes. The strain propagated in this laboratory possesses a strong proteolytic power which is considered to have an important bearing on the ripening of the cheese. The organisms are cultured daily in the laboratory in sterilised skim milk and are transferred to a bottle of sterilised milk prior to dispatch to a factory. This procedure ensures that the starter is in a vigorous condition and enables it to be used immediately for inoculating mother starter in the factory rather than having to subculture for several days before use, as frequently happens with some cultures.

Functions of the Starter.

In the manufacture of cheddar cheese the bacteria are cultivated in the milk with a view to bringing about the development of acid prior and subsequent to the addition of the rennet, as acid production is essential before the further changes in the milk constituents can take place. In factories where pasteuration of the milk is carried out, it is necessary to use a starter to inoculate the pasteurised milk with the desired acid-forming bacteria, and even where milk of comparatively high acidity is received and manufactured without pasteurisation the addition of a small quantity of a good starter is beneficial, as it tends to suppress the undesirable bacteria in the raw milk. When the rennet is added to the milk there must be large numbers of bacteria present, and during the coagulation most of the bacteria are incorporated in the curd. Further growth of these bacteria goes on during the manipulations in the vat and in the early stages of ripening of the green cheese.

The effects of the acidity developed by the starter are fivefold—

(1) To ripen the milk. Ripening the milk favours the coagulation when rennet is added. If the milk were of too low acidity it would curdle slowly with rennet and the manufacturing period would be prolonged.

(2) It favours the expulsion of the whey. The bacteria which are trapped in the curd cause acidity to develop, the curd shrinks and the whey is expelled.

(3) It favours the fusing of the curd particles (matting). This gives a mellow body and texture to the cheese.

(4) It has a protective action against putrefaction. The putrefactive bacteria, being susceptible to acidity, will be restrained in the acid medium, but would quickly spoil the cheese if acid were not present to check their activities.

(5) It favours the action of the pepsin present in the rennet extract. Rennet extract not only has a curdling action due to the enzyme rennin, but also a digestive effect in the presence of acid owing to another enzyme known as pepsin. The pepsin commences to break down the indigestible curd in the vat and continues its action in the ripening room until there is produced a nutritious matured article.

Vitality of Starters.

A most important property which must be possessed by a good starter organism is the ability to produce acidity steadily throughout the making operations. Often a starter will commence to develop acid when it is first introduced into the vat, but fails to maintain its virility when the "cooking" and cheddaring stages are reached. During the "cooking" the temperature of the milk is raised to 100°F., and in extreme cases to 104°F., temperatures which are higher than the optimum for growth of the lactic acid batceria used in the starter, while in cheddaring the curd is comparatively dry, which is unfavourable for the best development of the bacteria. Unless the vitality of the starter is good there is the possibility of its becoming devitalised in these operations and causing much annoyance through failure to continue regularly to increase the acidity.

Loss of vitality by starters has received much study in recent years. Singleton states that getting starters constantly over-ripe is a means of decreasing their vigour (1). Several workers have referred to the action of certain bacteria in the milk retarding the growth of the starter bacteria (3), (10). The milk itself has also been blamed for possessing some obscure abnormality, but in most factories plenty of milk can usually be found which will make good starter (2). Milk from sick animals should, of course, never be used (3). Mammitis milk is a frequent source of trouble in the preparation of starters (2).

A test for the vitality of starters which was developed in New Zealand is applied constantly to the starter organisms kept in this laboratory and gives a good indication of how the starter will behave in the cheese vat (4).

Failure of Starters.

The sudden failure of a starter or the slow development of acidity, which prolongs the period of manufacture, are two common problems which confront the cheesemaker, and are often traced to the following causes:—

(1) *Mammitis Milk*.—Milk from animals suffering from disorders of the udder is commonly responsible for slow development of acidity in the vat. Recently the services of this laboratory were sought by a factory which has had trouble for months. Microscopical examination of the milk from each individual supplier indicated that no less than five suppliers were sending in mammitis milk. With the rejection of the milk from affected beasts the batch worked normally on the following day.

(2) *Non-acid Milk*.—Certain organisms produce an inhibitory substance which retards the growth of the added starter bacteria (5), (6), (7). Managers who suspect this, or mammitis milk, to be the reason for starter failures are advised to communicate with the Cheese Instructor or the Dairy Bacteriologist now stationed at the Toowoomba branch laboratory, who will endeavour to visit the factory, examine the milk received to detect the supply which is causing the trouble, and give instructions to the farmer concerned.

(3) Recent work at the New Zealand Dairy Research Institute has shown that a phenomenon known as bacteriophage is probably a most important factor in the sudden failure of starters. The bacteriophage may be described simply as a destructive parasite of bacteria. Up to the present no sure method of preventing the destruction of starters by the action of the phage has been found. The indications are that the bacteriophage originates in the cultures themselves and that its development is conditioned by an unknown factor in certain milk supplies (11), (12).

Purity of Starter.—Factory managers desirous of knowing the state of purity of their starter could arrange also for a sterilised bottle to be sent to them in which to return a sample of the starter for bacteriological examination.

Contamination of Starters.

A badly contaminated starter may often be quite active in the vat and show no abnormality in flavour or aroma. The activity may even be due to the contaminating organisms which, by their action on the milk, render it a more favourable nutriment for the starter bacteria. However, the undesirable effects of using a contaminated starter, although not apparent in the vat, become evident in the matured cheese and cause it to be placed in an inferior grade. The following quotation expresses aptly the risk involved in the use of a bad starter:—"A contaminated starter which goes well in the vats gives a false sense of security, for although the green cheese may appear satisfactory, no one can say what off-flavours may develop with maturity. On the other hand, a pure starter which loses its vitality gives rise to abnormal conditions in the vat for a day or two, but the cheesemaker cannot fail to realise the trouble and take immediate steps to rectify it. However, some factory managers who take special care to avoid contaminating their starters experience more than their share of trouble. This is partly because a pure culture is more sensitive than a contaminated one to slight changes of conditions, and so will more readily 'go off.' Such changes of conditions are chiefly three—(*a*) Changes in the milk; (*b*) inoculation with varying amounts of starter; (*c*) variations in temperature of starter milk—in cold weather sufficient acidity may not develop, while in hot weather the reverse may happen" (^{2}).

Examination of starters at factories frequently shows them to be contaminated with yeasts and moulds, which grow quite well in an acid medium, and so the contamination becomes progressively worse as times goes on.

Many bacteria which enter the starter will die out on account of the inhibitive effect of the acid medium, but it is possible to reinfect the starter from day to day by some mistake, such as dipping some of the starter out of the bulk starter with an unsterilised spoon or other utensil, or inserting in it an unsterilised thermometer or stirrer. Some managers place the starter can in the cheese ripening room, because of the more even temperature to be secured there, but this practice is to be condemned because mould spores, which are universally present in these rooms, are sure to contaminate the starter; as has been mentioned, these organisms grow in the acid medium and are detrimental to the quality of the matured cheese. The cheesemaking room is also an unsuitable place in which to allow starter to ripen on account of the high temperatures and the risk of contamination from splashes of water and other sources.

Preparation and Care of Starters.

The length of time that a starter can be kept in a factory without obtaining a fresh culture from a laboratory will depend upon the care which is given to its preparation and the method by which it is carried on from day to day. Some factories have a standing order to be supplied with a new starter fortnightly, some monthly, and some three-monthly, while other factories only procure a fresh culture when that in use shows obvious signs of deterioration. In New South Wales, where the method of carrying starters in the factories closely resembles bacteriological technique, some factories have kept a starter in an uncontaminated condition for years (^{8}).

The cultures are sent out from this laboratory in sterilised milk in 4-oz. medicine bottles. Immediately upon receipt of the package half a teaspoonful of culture should be inoculated into about a pint of pasteurised milk in a bottle, thermos flask, or other suitable container, the milk being pasteurised in the container, so that the most favourable conditions possible are provided for the starter organisms. The distance of most factories from Brisbane is over 100 miles, transport is rather slow, and temperatures in the warmer weather are relatively high; hence the culture will generally have coagulated by the time it reaches the factory. When the milk coagulates there is no further growth of the lactic acid bacteria and they gradually die out, so the first inoculation from a newly acquired laboratory culture should be rather heavy because its vigour has diminished, but after several propagations an active starter should be secured.

Milk for Starters.

Only the best quality milk should be used for the cultivation of starter bacteria. Mixed milk from a herd is preferable to that from a single cow, because certain cows give milk which hinders the growth of starter bacteria. Knudsen, one of the foremost authorities on the subject, also states that milk for starters should be rich in total solids (³). Managers can check the total solids of their milk by indirect estimation from the lactometer reading and percentage of fat, according to the following formula:—

Total solids = $\frac{1}{4}$ Quevenne lactometer reading x 1·2 fat plus 0·14. The milk should also be of high initial acidity, as mammitis milk frequently is of low acidity. It is important to make the acidity test soon after the milk is produced in order to avoid the risk of slight souring creating a false impression.

Preparation of Mother Starter.

Much better results would be achieved in many factories by keeping a mother starter. It is well understood that cheesemakers are fully occupied by their duties, but the extra time required to do this work would be quite inconsiderable and it would assist to prevent the carrying over of a fault which may develop in the bulk starter on any day. In this connection I quote from a letter received from one manager—"We are getting much more satisfactory results than last season, and any trouble in the bulk starter now occurs for one day instead of being carried forward every day." Utensils which are used to hold the mother starter include glass jars, thermos flasks, and so on. They should be of about 1½ to 2 pints capacity, and about 1 pint of milk should be added to them, so as to leave ample space above the surface of the milk in the event of splashing taking place during pasteurisation.

One method of pasteurising is to place the vessel containing the milk in a saucepan, add water to the saucepan till the surface of the water is level with that of the milk—then heat until the water boils and hold at this temperature for twenty minutes. The milk is cooled to about 70° Fahr. before the culture is added, the cooling being allowed to take place slowly if the vessel is of glass in order to save it from cracking. A few drops of starter only are needed to inoculate the milk—0·5 cc. should be ample. A good way to do this is to use a narrow hollow glass tube or a straight-sided 2 cc. pipette, which has been sterilised in boiling water or steam, for transferring from the coagulated culture into the pasteurised milk.

A much better method of preparing mother starter and which eliminates much of the risk of contamination is to pasteurise the milk in a steamer. An account of the method used at Gatton College has been given to me by Mr. R. R. Keats, Dairy Instructor at the College, and is as follows (⁹) :—

A steam steriliser was made at the College for use in connection with the propagation of pure cultures and mother starter. The materials used in its construction were an 8-gallon petrol drum, some plain galvanised iron, rivets, some ½-inch piping, and three ½-inch back nuts. The design is simple, and for those who wish to construct the steriliser the following details are given:—

First cut the top from the petrol drum. Two holes are then cut in the bottom sufficiently large to admit ½-inch steam piping (approximately ¾-inch diameter), one in the centre and the other nearer the side. Over the latter hole on the bottom of the drum is sweated one of the back nuts into which is fitted a short piece of piping. Another piece of piping 2½ inches long with a thread 1¼ inches long and fitted with one back nut is passed through the centre hole, thread first, and the other back nut screwed on the outside to make secure. Eight right-angle supports are made from ¾-inch wide strips of iron cut from the top of the can, four of these being riveted to the inside of the can, at equal distance apart and 3 inches from the bottom, the other four being similarly fixed 11½ inches from the bottom. A disc of galvanised iron 11½ inches in diameter is cut and perforated with a number of ½-inch diameter holes. To the centre of the bottom of this disc or platform

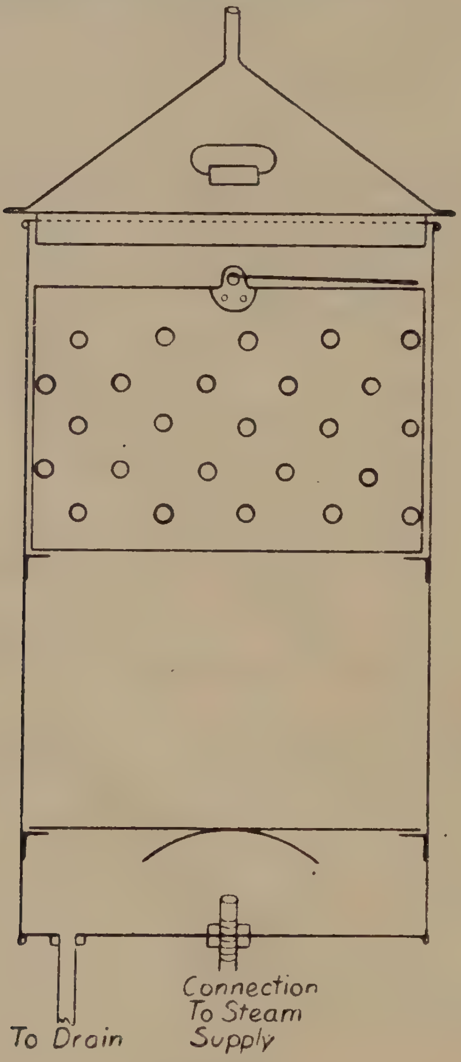

Plate 10.
Steam Steriliser, Q.A.H.S. & C. Scale, ⅛ inch to 1 inch.

is riveted a steam baffle plate made from the top of the drum 5 inches diameter and made saucer-shaped. The top container consists of a bucket, made from galvanised iron, perforated with ½-inch diameter holes on the sides and bottom and provided with a handle for removing it from the steriliser. Its measurements are 11½ inches diameter and 8 inches deep. The lid, made from galvanised iron, is conical in shape, fitted with a ½-inch pipe at the top for the escape of steam, also two wire handles. The steriliser is mounted on an iron bracket attached to the wall and is connected with the steam supply, to the fitting at the centre of the bottom of the drum. (*See* Plate 10.)

Operation.—Glass jars, or test tubes of milk, flasks, &c., are placed in the steriliser, either on the bottom platform or in the top container and the lid placed in position. The draining valve at the bottom is opened slightly and any condensed steam water allowed to drain off, including any from the steam inlet pipe which is also opened slightly.. The correct amount of opening may then be given to the steam inlet valve and steam admitted to the chamber. The escaping steam should just be blowing slightly from the escape pipe in the lid when properly adjusted. Before removing the lid from the sterliser turn off the steam supply and allow if possible fifteen to twenty minutes to elapse before opening, to avoid cracking of glassware due to a possible sudden drop in temperature. Keep the draining valve slightly open during sterilisation.

After the addition of the drops of culture to the milk, mix by gentle shaking, and incubate at 70° Fahr. It is important to maintain a uniform temperature during incubation. The milk should be coagulated in from eighteen to twenty hours, and the coagulated mother starter is used for inoculating the larger quantity of pasteurised milk to be used for the bulk starter on the following day. By careful daily observation of temperature, number of drops of culture added, and the time taken to coagulate, the cheesemaker can regulate conditions so that the mother starter is just firm by the time it is ready to use for making bulk starter.

Avoid Enamelled Billycans.

The use of enamelled billycans to hold mother starter, although very common, is considered unwise, because of the ease with which the enamel becomes chipped or scratched, leaving crevices which will harbour undesirable types of bacteria unless rigorous sterilisation is carried out.

Preparation of Bulk Starter.

With the large quantity of milk required for this purpose, heating and cooling are preferably done in a vessel through which steam and water from the factory supply can be circulated. The quantity of milk which will be needed will vary according to the volume of milk treated at the factory. Place the calculated amount of milk in the starter can, which should be fitted with a metal lid, fill the outer vessel with water, and raise the temperature of the milk to 180° Fahr. by injecting steam into the water through the steam inlet valve, keep at this temperature for one hour longer, and then cool to 70° Fahr. by shutting off the steam, opening the water inlet valve and passing cold water through until the desired temperature is attained. Now inoculate with the mother starter, which should be just firmly coagulated. The usual quantity found necessary is about three-quarters of a fluid ounce per gallon of milk. On the following morning when this milk has coagulated it will be ready to add to the cheese vat.

As with the mother starter, conditions should be regulated to have the bulk starter just firm when ready for use, but should it be necessary to hold it for some time, it should be placed in cold water at 50° Fahr. to prevent the attenuation of the bacteria which takes place after coagulation of the milk.

Mr. Keats has given me the following description of the method of pasteurising milk for the bulk starter at Gatton College:—

"To pasteurise milk for the making of bulk starter, a special vat and can is used, in which the milk is both heated and cooled. For college purposes a 5-gallon can is sufficient, but, of course, a larger outfit may be constructed on similar lines if desired. The can is made from stainless steel, has a rounded base and no seams, all joins having been electric welded. It is provided with a conical-shaped lid. The heating vat is constructed of heavy-gauge galvanised iron, has an overflow pipe near the top, and is fitted with a perforated pipe at the bottom which is connected outside to the steam and water supply.

"*Operation.*—The can containing the milk is placed in the vat, and the supply of water turned on until it flows through the overflow pipe. The water supply is now turned off and steam admitted to heat the water and thus heat the milk. A temperature of 180 to 185° Fahr. is held in the milk for a period of one hour, the steam supply being regulated to obtain this result. The water supply tap is now opened and cold water allowed to flow into the vat slowly until the milk is cooled.

"Although the heating vat, which was made by the college plumber, has been replaced three times owing to leaks caused by rust formation, the starter can which has been in use for eight years has retained its new appearance owing to the quality of the stainless steel used in its construction, even though abrasives, such as steel wool, are frequently

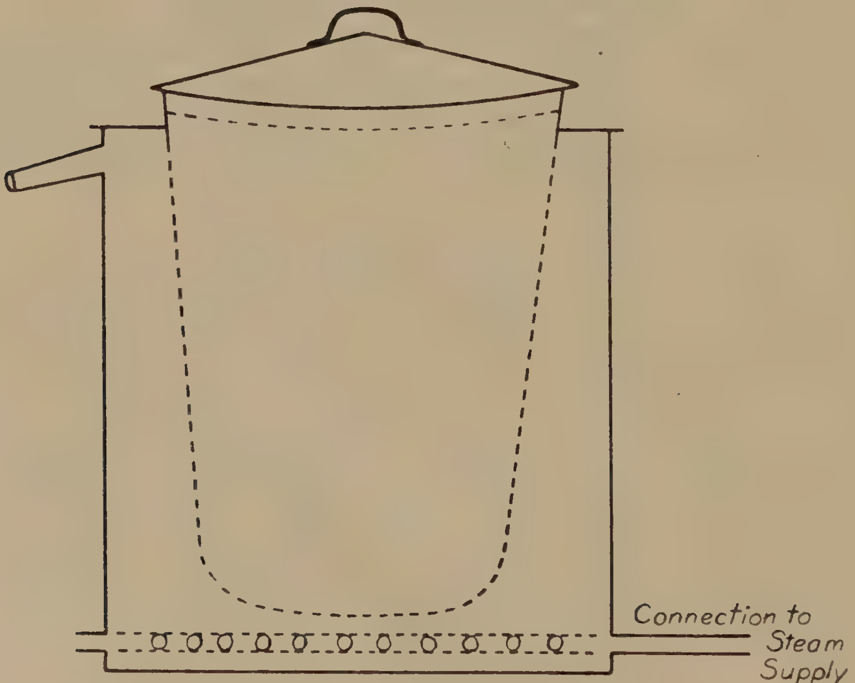

Plate 11.
Starter Milk Pasteuriser, Q.A.H.S. & C. Scale, ⅛ inch to 1 inch.

used to remove the film of casein which forms on the inside of the can. Usually, heavily enamelled buckets or billycans are used to 'set' the starter, but on frequent occasions the steel can has been used, with no apparent detrimental effect on the quality of the starter." (*See* Plate 11.)

Adding the Starter to the Vat.

For the manufacture of cheddar cheese from pasteurised milk about 1 to 1¼ per cent. of starter needs to be added to the vat. The quantity of starter to use for unpasteurised milk will, of course, depend upon the acidity of the milk. When unpasteurised milk is used for cheesemaking, the addition of some starter, by introducing large numbers of lactic acid bacteria of vigorous type, will assist to overcome undesirable fermentations, thereby improving the flavour and texture of the cheese. Care should be taken not to add too much starter; it is far better to add the quantity just stated, and if trial shows this to be insufficient, a little more can be used, but the addition of too much starter should be avoided. The starter should always be strained through cheesecloth as it is being added to the vat to ensure that lumpy particles do not get into the vat.

Examination of Starter.

The characteristics of a good starter are—

(1) A clean, acid flavour. The acid produced by *Streptococcus cremoris* alone may seem somewhat sharp to anyone unaccustomed to it, because of the absence of the associative organisms which give a milder flavour and fuller aroma to starters in which they are grown in association with *Streptococcus cremoris.*

(2) The coagulation should be smooth, free from whey and gas pockets. As the strain of *Streptococcus cremoris* propagated in this laboratory has strong proteolytic power it may digest the curd with extrusion of some whey and also produce a slight quantity of gas, if left standing after coagulation.

(3) If broken up it should be of a smooth, creamy texture, entirely free from curdiness.

(4) The acidity at the time of use should be between 0·65 and 0·75 per cent., and should not exceed 0·85 per cent.

Defects in Starters.

Malty Flavour.—A malty flavour sometimes is noticeable in starters, and will be conveyed to the cheese. It is due to a variety of *Streptococcus lactis,* which appears to gain the ascendancy at times. The defect cannot be remedied in the factory and the only course is to discard the starter.

Ropy Starter.—A ropy or slimy condition may suddenly appear in a starter and it may just as suddenly disappear. If it persists it will increase in intensity and the starter will have to be replaced. The condition appears to be associated with the absorption of oxygen from the air during the cooling of the milk after pasteurisation, as heating and cooling the milk in a narrow-necked vessel will overcome the fault. Continual inoculation from the surface of the starter will also induce this defect.

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CEREAL SEED TREATMENT.

Bunt and flag smut of wheat are two diseases which in the past have caused serious loss to wheatgrowers. In recent years the percentage of the total crop of this State, which has been affected adversely by these diseases is, fortunately, quite low. However, there occur instances of heavy individual loss, usually attributable to neglect of seed treatment. Seed from a source known to be free from flag smut and bunt (also known as ball smut) needs no treatment. All other wheat seed should be given a protective coat of fungicidal dust. The dust used most widely is copper carbonate, and this is quite effective in dealing with lightly contaminated seed. Seed which carries so many spores that it is noticeably dark should not be used, although it can, if necessary, be freed from infection by the old-fashioned wet treatment with bluestone. A recent development in seed treatment is the use of mercury dusts to replace the copper. The mercury dusts are somewhat more effective, and have superior physical properties; that is to say, they adhere to the seed better and do not fly in the air and do not tend to clog the drill, as does the copper carbonate. The copper dust, on the other hand, is less poisonous to animals and is cheaper. With reasonable care in keeping seed wheat separate from that used for feed, the poisonous nature of a dust should not be attended by any untoward results, and the cost of even the more expensive material amounts to only a few pence per acre. The mercury dust at present being marketed in Queensland is one of the most effective, and is known as Ceresan.

In the case of barley and oats serious difficulty has been encountered in this State in recent years in growing clean crops on account of the high percentage of smut present. This has been due largely to the fact that bluestone and copper carbonate fail to control these diseases. One of the older wet treatments —namely, that with formalin—is effective if applied correctly. Recent experiments have shown that a dust treatment is available for barley and oats. Ceresan and certain other mercury dusts will control the smuts of these two crops. Either the formalin wet treatment or the mercury dust dry treatment is also effective in the control of the covered smut of prairie grass. When Ceresan is used in the control of any of the above diseases it should be applied to the seed at the rate of 2 oz. per bushel.

New Highways in Queensland.

[*Continued from page* 829, *December,* 1936.]

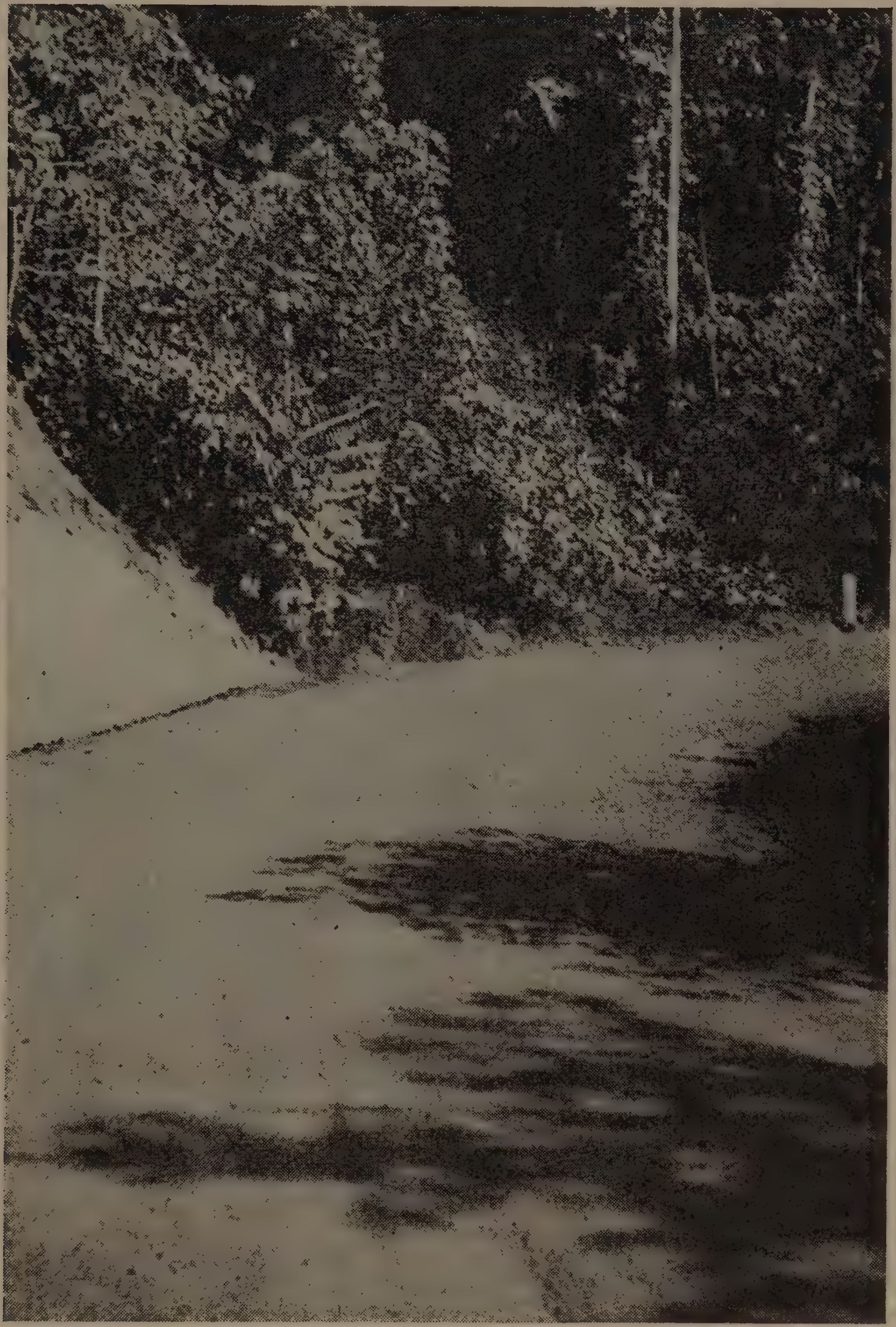

Plate 12.
A curve in the new road through the rich jungle lands of Palmerston, connecting Millaa Millaa with Innisfail.

Plate 13.

THE ROAD TO EIMEO.—A new highway giving easy access to a beautiful seaside resort near Mackay, and serving a rich cane-growing district.

Plate 14.
A bitumen-paved section of the Toowoomba-Warwick Road, Darling Downs.

Plate 15.
Through the rich grasslands of the Dawson River country. The road connecting Theodore with the Cracow Gold Mines.

Plate 16.
This multiple span log drain topped culvert over Reedy Creek, in the Kingaroy District, has replaced an old sandy crossing.

Plate 17.
This bitumen-sprayed paved roadway leads from the Lockyer to the Southern Darling Downs.

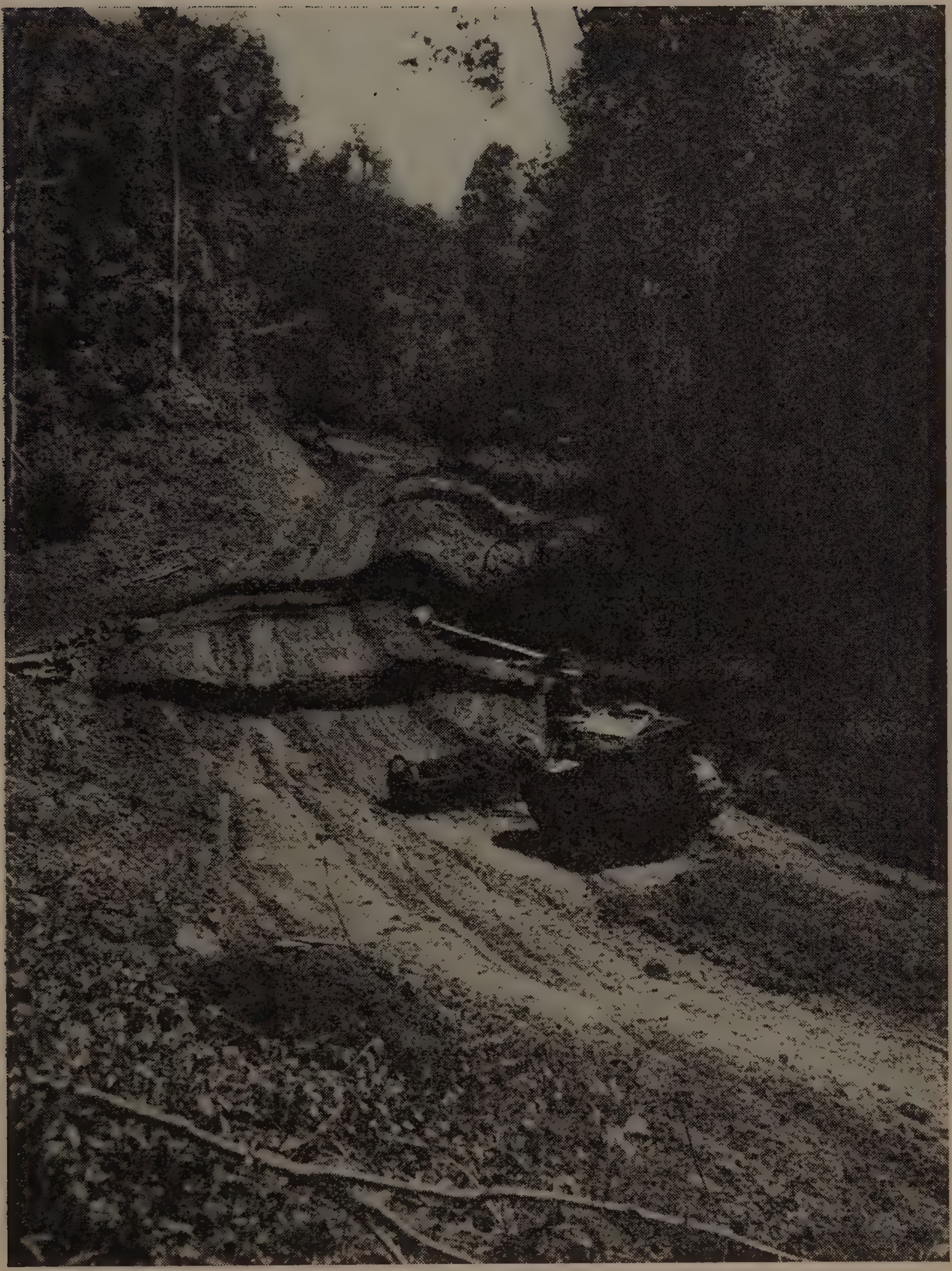

Plate 18.

Calen-Kungurri Road—Pioneer Shire—under construction. This will provide a link with canegrowing areas west of the main railway line.

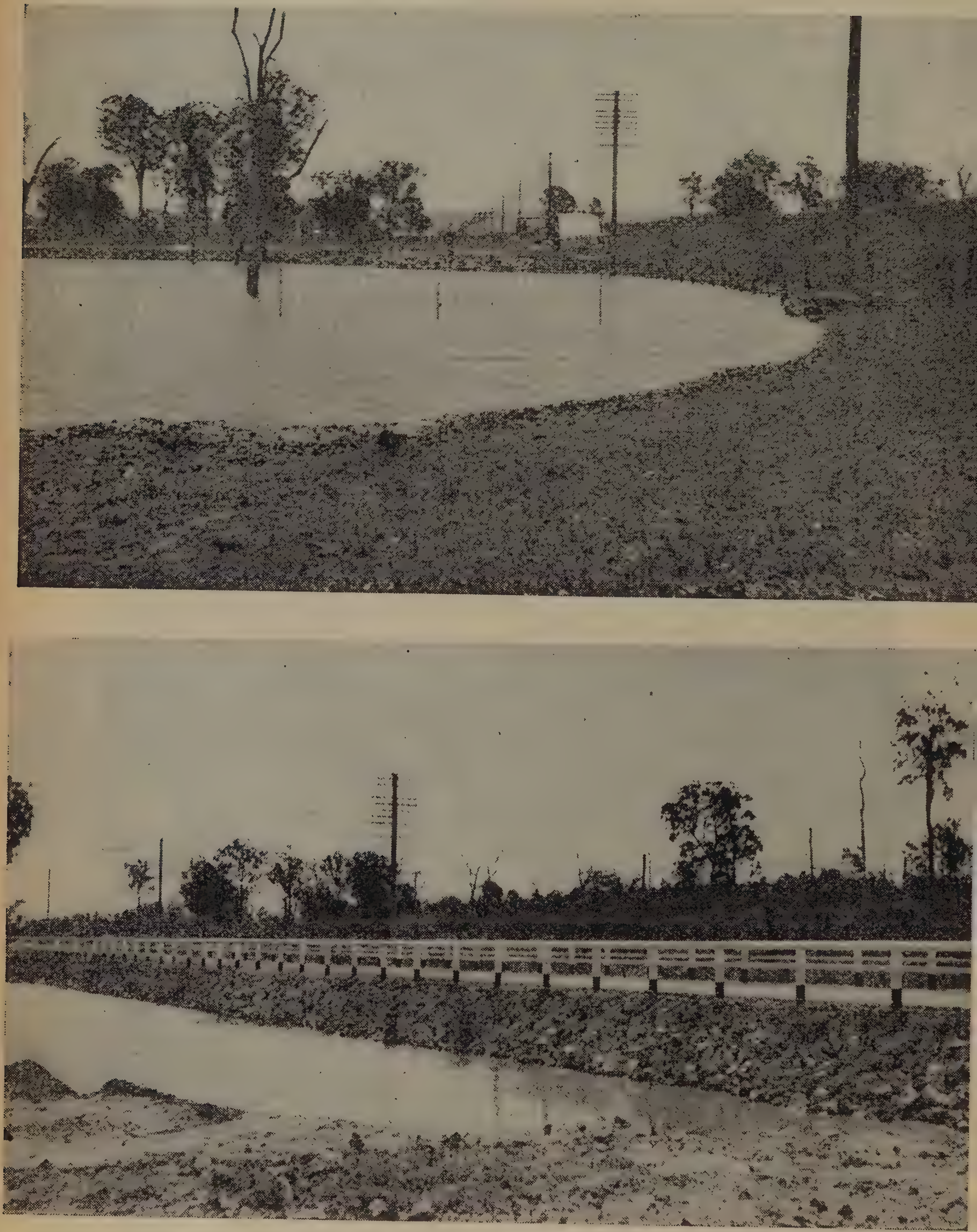

Plate 19.

Rockfill crossing over a lagoon near Helidon on the Brisbane-Toowoomba Highway before and after construction.

Plate 20.
Townsville-Moongobulla section of the Mount Spec Road, North Queensland.

Plate 21.
The first of the foothills come into sight on the road to Mount Spec.

Agricultural Notes

DECEMBER weather was unsettled throughout, with scattered storms and fair relief rains in many districts. The heavier falls were received from 12th December to the 17th December, replenishing water supplies and providing heartening relief over a large area of the Darling Downs and South-West. No steady general rains have been received, however, and many districts are still in urgent need of soaking showers. Pastures have responded rapidly wherever rain has been heavy enough, and many farmers have been able to plant maize and general summer fodder crops.

Wheat.

Seasonal experience indicates the necessity for improved cultural methods if the average yield is to be maintained. Reports show that although the season proved unfavourable, payable crops were harvested in every instance where the land was ploughed early and kept clean until the sowing period.

The spread of black oats is a matter of concern, indicating the desirability of long fallows combined with the growth of purely grazing crops in rotation with wheat.

The entire crop, apart from seed and feed requirements, has been sold to Queensland millers at a satisfactory price, growers having received payments covering the first advance of 3s. 6d. per bushel for Q1 wheat. Although farmers are compensated for lower yields by the rise in world wheat prices, the State as a whole will lose, owing to the necessity of importing approximately 3,000,000 bushels of Southern wheat to supplement local supplies.

Fodder Conservation.

The recurring periods of under-average rainfall, resulting in a serious decline in production, directs attention to the lack of any general provision against prolonged dry periods. Many farmers will, doubtless, adopt a more active policy of conservation in the future, both for use during dry spells and for normal winter and spring supplies, thereby maintaining production at a high level and keeping their stock in good condition throughout the year. An object lesson is provided by the coastal fodder conservation competition conducted by the New South

Wales Department of Agriculture. The fodder conserved is judged on suitability, quality, location, protection, economy, carrying capacity, and surplus. The winner of the North Coast championship, where droughty conditions similar to those obtaining in Southern Queensland have prevailed, had conserved 110 tons of chaffed maize and sorghum silage and 56 tons of lucerne hay. Although no grain was stored the fodder conserved was sufficient to feed ninety-three head of cattle for the stipulated period, notwithstanding the fact that the natural carrying capacity of the 115-acre property was assessed at thirty-one head. The crops cultivated on this farm included 20 acres lucerne, 18 acres maize and sorghum for fodder, 16 acres of oats, and 2 acres of pasture grasses.

Although the practice of fodder conservation has greatly increased during recent years, the total bulk of such fodder is still insignificant compared with the total number of stock carried throughout the coastal areas of New South Wales. In Queensland, practice in this connection lags considerably behind that of the Southern States. In New South Wales approximately 400 concrete tower silos have been erected during recent years, mainly for normal winter feed, the general practice being to store fodder intended as a drought reserve in trench silos which can be excavated cheaply as crops become available.

Tobacco.

The vital stage in tobacco seedling production occurs during the early period of growth, while the plants are small and possess a poorly developed root system. It is essential that abundant water be supplied, and that the beds never be allowed to dry out. The quantity of water required and the frequency of waterings will depend on climatic conditions. Under dry conditions, it may be necessary to water as often as three times a day during the first few weeks. As the plants grow and the root system extends, watering may be reduced to once daily. From the time of germination onwards it is necessary to protect young seedlings from the hot rays of the sun to an extent dependant on local conditions. The type of cover used would be determined by the subsequent precautions to be adopted against disease and insect attack.

Seedlings should always maintain a vigorous growth, and should there appear to be a serious retardation of growth at any time the application of a solution of nitrate of soda in water at the rate of ½ oz. per 4 gallons will, in most instances, sufficiently quicken growth. On the other hand, it is inadvisable to apply nitrogenous manures too liberally, or there would be a tendency to "soft seedlings," which will later be difficult to "harden off."

"Hardening off" should be a gradual rather than a sudden process, and the plants should be allowed an increasing amount of sunlight in the mornings and afternoons, until they can stand full sun during the whole of the day. The tendency of some growers to retard seriously the growth of seedlings is to be deplored. Very often it is found that when the plants reach a stage suitable for planting out weather conditions are such that planting in the field cannot be commenced with any degree of safety. Rather than retard the growth of these plants until planting-out can commence, it is preferable to have another series of slightly younger seedlings which can be utilised and the originals destroyed. The adoption of such a procedure would ensure a quantity of seedlings "hardened off," but at the same time in reasonably vigorous growth. Such seedlings are then able to make a rapid recovery from the shock of transplantation, and to make quick growth in the field.

Cotton.

Planting rains were experienced over many sections of the cotton-growing districts during the month, but owing to the lateness of arrival and the light nature of the rainfall in some sections an appreciable acreage will not be planted to cotton this season. This applies more particularly to the fertile alluvial soils of the older cultivations, where the experiences of past seasons have indicated that late plantings of this crop cannot be relied upon to produce profitable yields, especially in seasons experiencing wet conditions during January and February.

In the districts where the early rainfall allowed the crops to be started off in the normal planting season excellent progress has been made, and the most forward plants are flowering and setting a good load of squares and bolls. The general condition of the crop is, therefore, very mixed, and the nature of the season for the next three months will have a marked effect on the yield obtained. Fortunately, an increased area of the quicker-maturing varieties has been planted this season, which should help overcome the delayed start to a marked extent.

Sugar.

All cane areas from Mackay north received excellent rains during December, so that the crop in those parts is now making rapid progress.

Though relief rains have been received in the Southern districts, they are altogether too light to promote rapid growth, and a good downpour is necessary to assure the 1937 crop.

CROWN LAND FOR GRAZING HOMESTEAD SELECTION.

CUNNAMULLA DISTRICT.

174,931 ACRES OF SHEEP LAND—PART OF THURRULGOONIA RESUMPTION.

This land has been surveyed as portions 5, parish of Cotton, 1 and 2, parish of Magie, and 1 and 2, parish of Kumbogan, and will be open for Grazing Homestead Selection at the Land Office, Cunnamulla, on Monday, 8th March, 1937, at 11 a.m.

Each selection will be for a term of 28 years.

The annual rentals for the first period of 7 years are from 1d. to 2¾d. per acre.

Each selection must be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of 3 years.

The blocks are all good woolgrowing country and are artificially watered by bore drains, but more water may be required.

Free lithographs and full particulars may be obtained from the Lands Department, Brisbane; the Land Agent, Cunnamulla; and the Government Tourist Bureaux, Sydney and Melbourne.

The Dairy Farm

THE INFLUENCE OF FEEDING ON BUTTER-FAT.

F. C. COLEMAN, Inspector of Dairies.

VERY many dairymen hold strong convictions that certain feeds will increase the butter fat percentage of their cows. While it is perfectly true that a change from, say, ordinary grazing to special and extra feeds of balanced rations will result in a larger quantity of butter fat produced, this will have been brought about by an increase in the quantity of milk and not by any increase in the fat percentage. Butter fat percentage is an hereditary factor; a cow is a 4·2 per cent. cow or a 6 per cent. cow, according to her inheritance, and the manner of feeding will not alter the average percentage.

Many experiments have been carried out to determine the possibility of increasing the fat percentage by special feeding, particularly with feeds rich in fats, but the deductions were that if occasionally the fat content has been slightly increased over a very short period the milk quickly returns to its normal composition.

Experience shows that although a cow's butter fat percentage will vary at both milkings during the day, and also from day to day, due largely to uneven periods between milking, yet it is a constant factor taken over a long period.

It can be said that stock which are always well fed and in good condition will maintain their fat percentage at the normal level, as compared with cattle running on overstocked country and which are underfed and in poor condition; and whose tests would, consequently, be lowered. This is due to the fact that cows in poor condition use up some of their body fat to maintain the quantity in their milk, but eventually they become incapable of doing this, and although probably only giving very small quantities of milk, there will be a decrease in the fat percentage.

An increase in the butter fat percentage of the milk of a herd would probably be brought about by the use of bulls from dams noted for their high production tests. It is well known to those who study the herd books that there are families in each breed noted for their low tests, and also those noted for their high tests, and it is from the high production testing families that a bull could be carefully selected for the object in view.

MAT GRASS A MENACE TO PASPALUM PASTURES.

W. D. FRANCIS, Assistant Botanist.

IN the past five years mat grass or carpet grass has become a serious menace to the better class paspalum pastures of South Queensland dairy farms. In several localities this inferior grass has already established itself in the paspalum pastures with detrimental effects.

There are two different races or varieties of mat grass. One variety has flat, broad leaves, and in general the plant is pressed fairly closely to the ground. The other has narrower leaves, and develops upright shoots which bear leaves and seed heads. The broad-leaved variety is apparently the better variety from the aspect of palatability, as it is eaten much more frequently by stock than is the narrow-leaved kind. The broad-leaved variety is more often found in flats. The narrow-leaved kind is most frequently found on hills. In most instances the narrow-leaved variety is the greater menace to the paspalum pastures. Both varieties develop a slender seed-bearing stalk which carries two or three narrow spikes of very fine seeds.

Matgrass or carpet grass is a native of the Southern United States (North Carolina to Florida, Texas, and Arkansas) and tropical America.

Dairy farmers whose herds are maintained by paspalum pastures should keep a close watch to prevent this deleterious grass from gaining a hold on their pastures. In most districts mat or carpet grass is well known, at least to some of the farmers. In all cases where a strange grass with a vigorous habit has made its appearance investigation should be made. Precautionary measures are especially necessary if the grass is avoided by stock. When local farmers are in doubt, specimens of the suspected grass should be sent direct to the Government Botanist, Botanic Gardens, Brisbane, for advice. In these cases it is always desirable, where possible, to include material which bears seed-heads.

As soon as mat or carpet grass is found to have established itself on a farm immediate and effective measures should be taken to destroy it. For this purpose digging out and burning are recommended. Then a close watch must be maintained for the appearance of the young plants developing from seed in the ground. These fresh plants should be rigorously destroyed before they develop seed-heads, which will continue the menace of this inferior grass.

WHY CREAM TESTS VARY.

E. B. RICE, Assistant to Analyst, Dairy Research Laboratory.

MANY dairy farmers who receive factory returns showing variations in the fat tests of their cream are inclined to wonder why they can occur. Because, apparently, the cream is produced under similar conditions from day to day they cannot understand how there can be any variation in the tests. In reality, variations are bound to occur, and should the returns be always the same it points to something wrong with the testing.

Conditions under which the milk is separated lead to changes in the cream tests, and are chiefly to be accounted for by the following factors:—

1. Speed at which the separator is run.
2. Rate of inflow of milk.
3. Richness of milk.
4. Temperature of the milk.
5. Quantity of skim milk or water used to flush the bowl.
6. Smoothness of running.

To discuss these points in their order:—

1. The separator should always be run at the speed directed by the maker to obtain maximum efficiency. It is better to turn at too high a rate than too slow, for, in the latter case, the fat loss in the skim milk is increased in proportion to the decrease in the number of revolutions below the recommended speed. Turning at too high a speed gives a richer testing cream, but may be injurious to the mechanism of the machine.

2. The level of the milk in the bowl is controlled automatically by the milk float, and it is necessary that the milk be allowed to enter the bowl freely during separation. If the flow be partly shut off a higher testing cream will result, but an over supply to the bowl will lower the test, and, what is more important, excessive fat loss will occur, with a consequent reduction in the farmer's income. Therefore, in order to obtain best results, see that regularity of inflow is maintained.

3. The daily variation in the fat content of the mixed milk from a herd is sometimes appreciable. This affects the test of the cream supplied, but is without influence on the quantity, provided other conditions are similar from day to day. For example, in the cream obtained from 100 lb. of milk with a fat test of 4 per cent. there are 4 lb. of butter fat; while in the cream from 100 lb. of milk obtained from a herd giving milk with an average fat content of 5 per cent. there are 5 lb. of butter fat, although the same quantity of cream is yielded in each case, if all other conditions are identical.

4. As it comes from the cow, milk is at the best temperature to be separated; being near 90 degrees Fahrenheit it is less viscous than at lower temperatures, so runs easily through the separator, and more perfect separation of the fat results. At lower temperatures, due to the viscosity of the milk, separation becomes more difficult, with greater fat losses, and, in fact, it is doubtful if any machine will do good work if the milk is below 80 degrees Fahrenheit.

5. The quantity of skim milk or water used to flush the bowl usually varies considerably from day to day, and may be responsible for a variation in the test of 2 to 5 per cent., depending on the quantity of cream.

6. Vibration causes the skim milk and cream to be shaken together, so that they do not find their way to their respective outlets. Fat losses are increased then by the escape of fat globules through the skim milk outlet.

Other factors which influence the fat losses are the cleaning of the separator and the condition of the milk, but these should not cause any difficulty where a proper appreciation of the need for hygienic methods in the production of such perishable commodities as dairy produce is realised.

Horticultural Notes

MARKETING BANANAS.

J. H. GREGORY, Instructor in Fruit Packing.

WITH the commencement of the deciduous fruit season, banana growers are again faced with the low-price period, and are striving to obtain the best price possible for their fruit. A visit to many plantations reveals practices the ill effects of which are seldom seen or even realised by the grower but which help to render fruit unattractive when the case is opened in the market, and in this way help bring a lower return than might otherwise have been received. The following suggestions are offered with a view to assisting growers to market fruit of an attractive appearance.

During the present hot weather bananas which have been cut and left exposed to the sun for only a short period soon become quite unfit for marketing, and the pulp is eventually reduced to a soft, boiled condition. Cutting should be done in the early morning, before the heat becomes severe, and care should be taken to keep the fruit covered thoroughly, even from the early morning sun, while waiting to be carried or wired to the packing shed.

The fruit should at all times be handled with the greatest care—in fact, the less it is handled the better—and for this reason it is wise to have the packing shed right in the plantation, if possible. On cutting the bunch it should not be laid carelessly at the foot of the stem, which usually means it rests on a bed of sticks and dead weeds. A bed of leaves is easily and quickly formed if the bunch must be set down in the plantation, though a better plan is to carry it straight into the shed or to the end of the wire and there place it in an upright position on bags or trash with the stalk leaning against a rail provided for the purpose. In this manner only a minimum number of fruit will be damaged.

On being dehanded the fruit should be allowed to drain for a few hours. Packing immediately after dehanding sweats the fruit in the case and renders bruising much easier. Care should be exercised to ensure that fruit which is "sprung" or in the early stages of ripening is not packed, as this will quickly be reduced to pulp and be most unsightly in a case of otherwise sound bananas. No fruit should be packed for Southern markets from bunches in which some of the fingers are already showing colour indicating ripening. The fruit should be dehanded just at the collar joining the fingers to the main stalk. The most suitable knife for this work is one of a sharp, flexible, and fairly narrow type.

There is a right and wrong way to separate the hands into singles. Tearing the bananas apart endways often peels part of the skin from the fruit and also bruises the stem, thus setting up an entrance for organisms responsible for black-end. The correct method of separating into singles is to grasp the cluster firmly with both hands at the stem end, then twisting one hand forwards and the other backwards, the fruit is separated easily and without any damage to the stalk end.

On completion of packing the cases should be packed on their sides in a cool, shady position to await transport to rail or market.

MARKETING PASSION FRUIT.

J. H. GREGORY, Instructor in Fruit Packing.

WITH the advent of warmer weather passion fruit growers should exercise greater care in the harvesting of their fruit. Fruit should not be allowed to fall from the vines as fallen fruit quickly becomes crinkled, reducing its size and value to the retailer. By picking the fruit when it is showing half colour its marketing life will be greatly increased, and its selling value raised. Where a grower has a percentage of crinkled fruit, it should be included with marked and blemished fruit and packed separately from the uncrinkled fruit. While most retailers have no outlet for crinkled fruit, there is, however, a good market for fruit of this description.

All fruit should be carefully handled and packed on the diagonal system, which gives the fruit the maximum of protection and display value, thereby greatly enhancing its general appearance.

Citrus Culture in Queensland.

R. L. PREST, Instructor in Fruit Culture.

[*Continued from p.* 812, *December*, 1936.]

PRUNING OF CITRUS TREES.

IN Queensland there is a wide divergence of opinion on the subject of citrus pruning, which is probably due to the influence of individual pruners who have developed certain systems which they believed suited their trees.

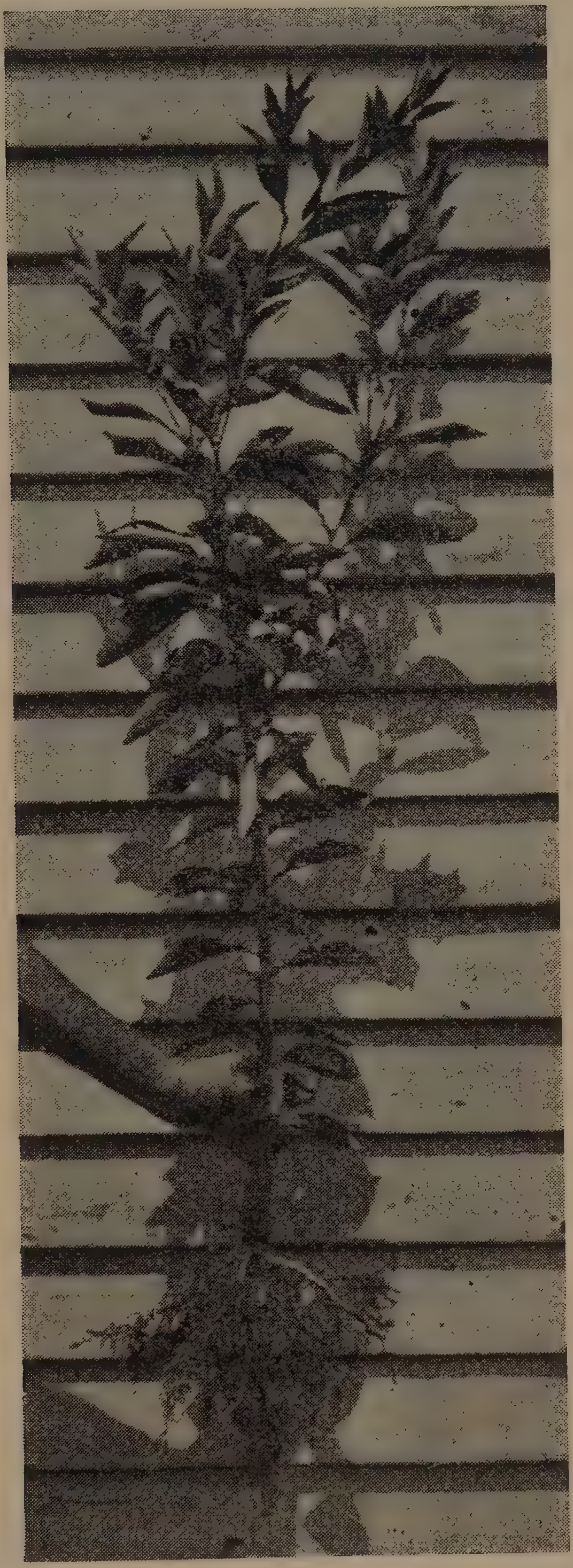

Plate 22.
A desirable type of nursery tree.

Pruning has, as a consequence, generally developed into a mechanical procedure rather than one based on an understanding of principles involved.

In general terms the method of pruning depends on—

(*a*) The age of the tree.
(*b*) The variety of the tree.
(*c*) The type of tree (whether vegetative or fruiting).
(*d*) Soil and cultural conditions.

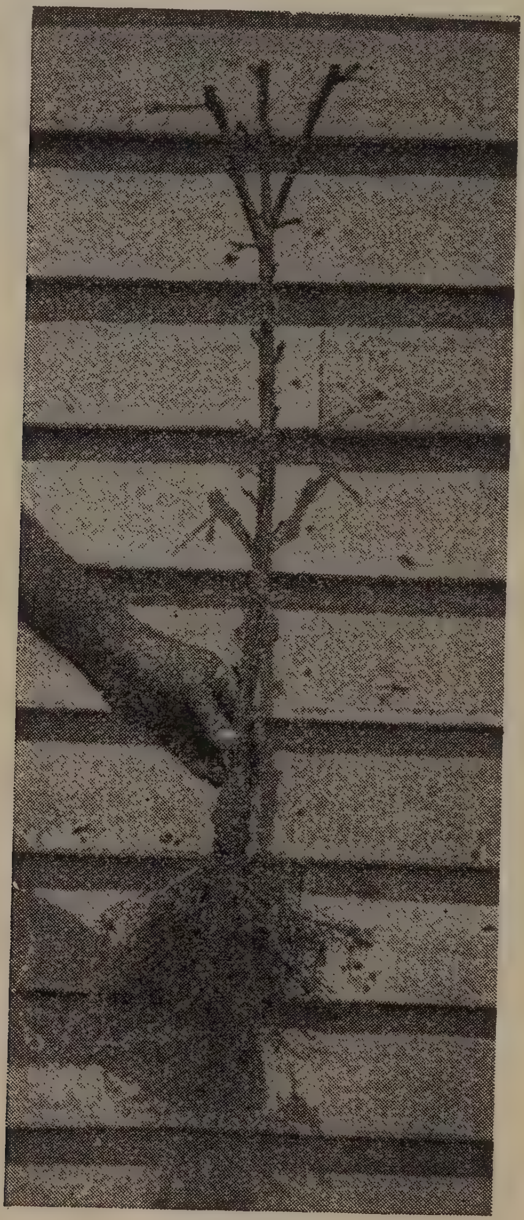

Plate 23.

The nursery tree shown in Plate 22 prepared for planting.

The main objects in pruning may be classified as follows:—The training of young trees; the removal of undesirable limbs; the modification of form to meet economical and cultural requirements and to counteract unfavourable climatic conditions; the removal of injured and worn out parts; the renewal of old and decadent trees.

PREPARATION OF NURSERY TREES FOR PLANTING.

The present day tendency of nurserymen is towards the practice of sending out trees carrying large heads, and in some instances shaping their prior despatch. The former method is best, as the planter is better able to shape the trees as he desires them. The latter is of little benefit owing to damage which may be sustained to some of the branches during transit.

The rooting system should be well washed prior to planting in order to remove any of the mud puddle which may be adhering thereto. Bruised and broken roots require to be shortened, and the head of the tree should be shortened and shaped to develop evenly.

Plate 24.

A newly-planted tree. Note that the union of the stock and scion is well above ground level.

TRAINING YOUNG TREES.

The pruning of young trees in the orchard should be confined to the removal of adventitious shoots from the stem, and the checking of excessively vigorous growths from the main arms.

It will be noted from Plates 23 and 24 that three main arms have been left on which to build the future tree. Two secondary arms only should be permitted to grow from the ends of each of these main arms in order to develop a strong and well-shaped top. Other secondary arms will grow but should be removed. Undesirable shoots which grow all along the main arms, and which obviously are out of place, would by their continued growth weaken the framework of the tree and should be cut away. In instances where awkwardly-shaped trees are received from the nursery it is often possible to train a shoot which ordinarily would be out of place to develop and fill up a gap. Such training involves shortening back the required shoot at some dormant period of growth to a bud pointing in the direction it is desired the shoot should grow. Remember that a shoot can be trained in any direction by cutting back to a bud pointing in that direction. Long weak limbs that do not show a tendency to branch should be headed back generally to the limit of the other growths, so that the tree will grow strong, compact, and symmetrical. The top should not be allowed to become too dense; on the other hand it should not be kept so open as to permit the sun scalding the main limbs and branches.

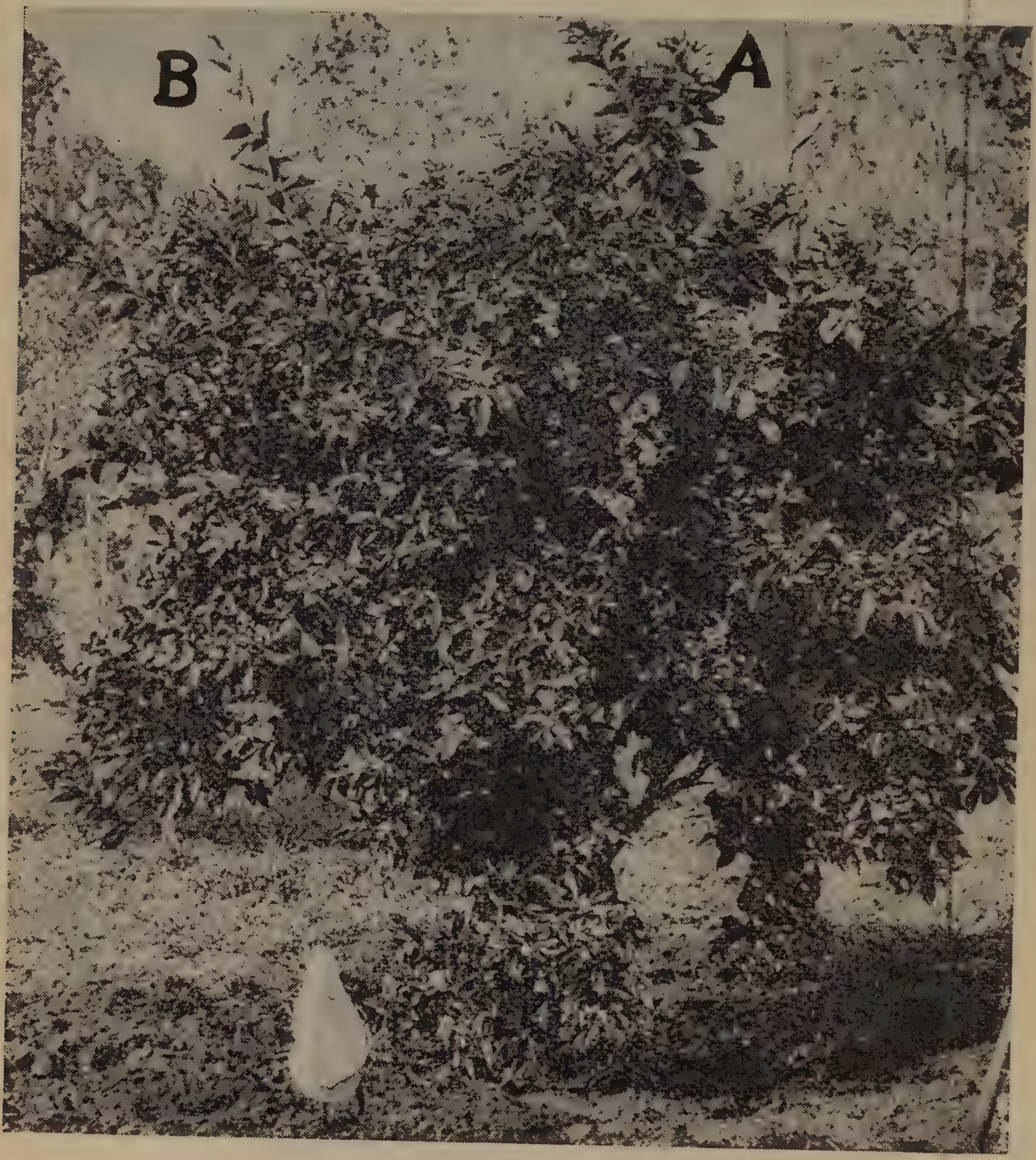

Plate 25.
Four-year-old Valencia Late.

It is worthy of note that where special bud-selected trees have been planted, they have consistently grown into shapely desirable trees and require very little attention from the pruner.

Plate 25 illustrates a young Valencia Late tree showing growth typical of this variety. This tree requires little pruning beyond the removal of any misplaced or excessively vigorous limbs such as those at the top marked A and B, which can be cut right back to their source. Any dead twigs and crowded foliage would naturally require to be removed.

Plate 27 illustrates a four-year-old Washington Navel and shows typical sucker growths, the treatment of which is sometimes apt to puzzle the pruner.

Plate 26.

The tree in Plate 25 after pruning. Note that the excessively vigorous limbs marked "A" and "B" have been removed.

As a rule such sucker growths may be considered parasitic, but they do not necessarily remain so, for in many instances they later produce bloom and fruit of normal fulness. Generally in practice it is a good plan to remove such growths, remembering that the fact that they can be curbed and induced to fruit makes it possible at times to utilise them for replacing broken and damaged limbs.

Provided that a well-developed framework has been maintained, young well-grown citrus trees should come into profitable bearing at an age of between four and six years. During the first years of bearing pruning should be directed towards the removal of suckers and decadent first-fruiting shoots. Where pruning operations have been diligently carried out on young trees, they require very little pruning during several following years, though they should be gone through annually and suckers and dead wood removed.

There is no doubt that the low production in the case of many old but well cared for orchards is due to the lack of vigorous healthy fruiting wood. This condition points to the necessity for a periodical renewal of fruiting wood, which can be best accomplished by thinning out and at the same time shortening back terminal growths and twigs. The cuts should be made right back to strong new growths, removing weak shoots and those that have borne fruits. The thinning leaves space for the necessary subdivision, whilst the shortening back tends to force into growth dormant buds from behind, stops the excessive growth of any branches, and at the same time renews supplies of fruiting wood. Where crowding is evident, the removal of entire branches is at times desirable. The entry of plenty of light and air assists the growth of healthy and vigorous shoots from behind the outside ring of foliage. These shoots make new fruiting wood. Any excessive growth of suckers or water sprouts arising from well inside the tree following heavy pruning require to be cut away or they will absorb a lot of the vigour of the tree and crowd the centre.

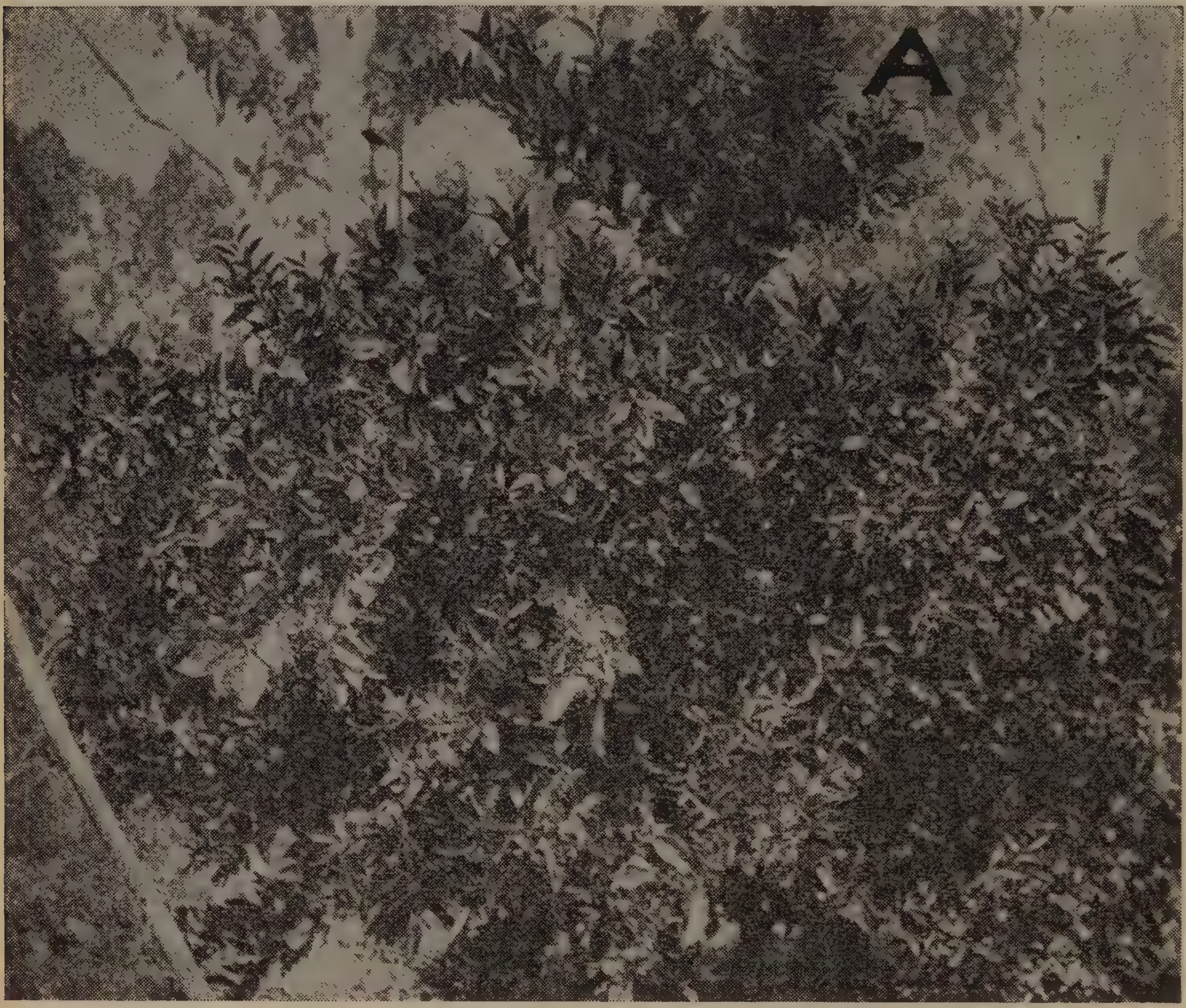

Plate 27.

Four-year-old Washington Navel, showing typical sucker growths.

In older trees where vitality has been impaired, provision will require to be made for the renewal of old crowded and decadent limbs. In such instances pruning is of a much heavier nature, requiring the removal of entire branches. Such branches should be cut right back to their source of origin, so that the sap is readily diverted to the remaining limbs, encouraging new fruiting wood. Under no circumstances whatsoever should stubbing be resorted to. In instances where it is necessary to replace the larger limbs the work requires to be done gradually over two or more years to avoid excessive suckering.

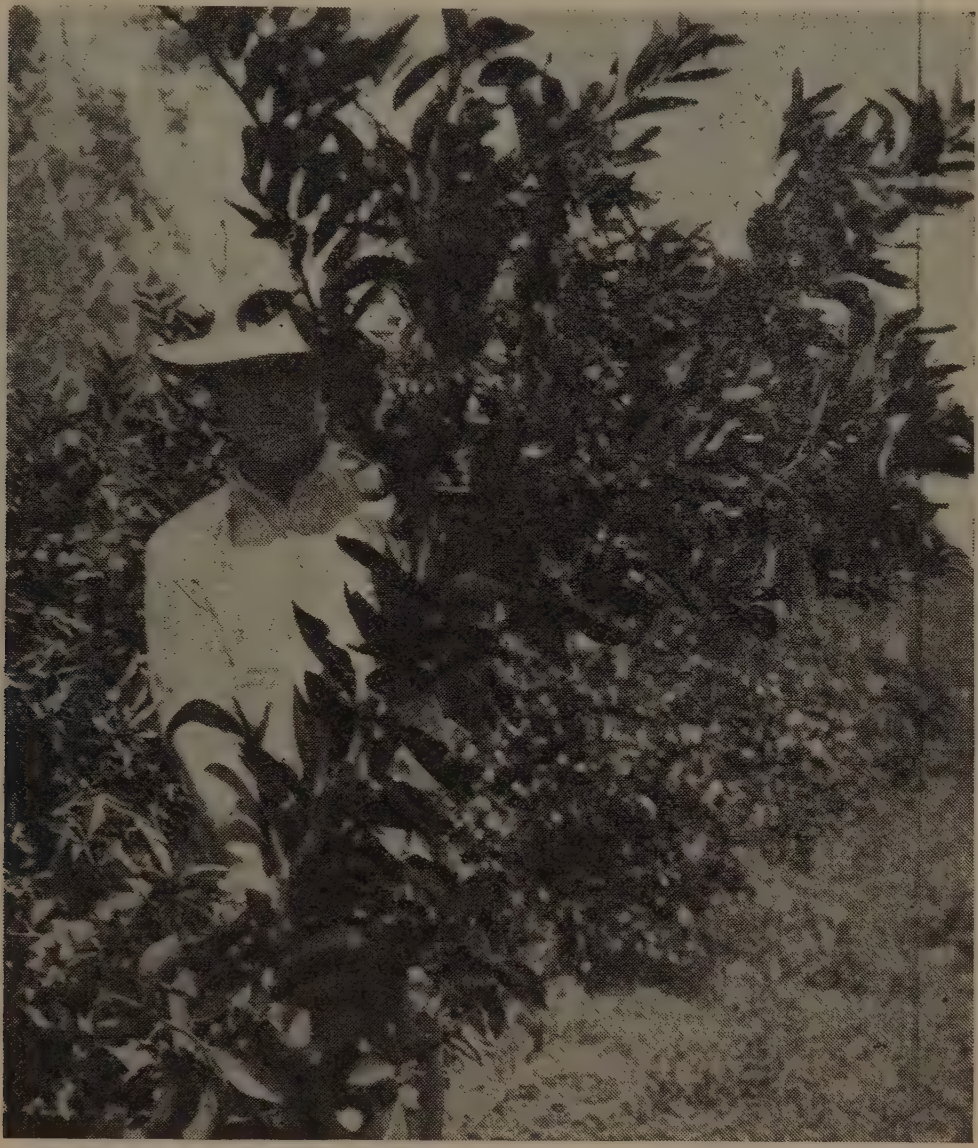

Plate 28.

Sucker, marked A at the top of tree shown in Plate 27, after removal.

Lower branches of the trees should not be allowed to touch the ground, as fruit borne on such branches is generally blemished and of poor quality. On the other hand trees should not be pruned too high from the ground. The height to which they should be lifted varies according to circumstances; in most instances knee-high will prove to be satisfactory.

In Queensland the regular thinning and pruning of bearing trees is definitely necessary. Frequent and regular treatment tends to preserve as nearly as possible the balance between the root system and aerial portions of the tree, assists in the control of economical and cultural requirements and counteracting unfavourable climatic conditions.

MANDARINS.

The majority of mandarins when not systematically trained and pruned are often merely shrubs, not trees. They naturally grow very densely, and unless regularly thinned out and shortened back after the fruit has been harvested the massed twigs become so dense that many perish and the remainder are so weakened that only small inferior fruits are produced.

Plate 29.
The tree in Plate 27 after pruning.

The treatment at planting is identical with that of the orange. After the first season from planting numerous vigorous upright shoots arise from the head of the tree. While small these should be thinned, leaving only those which will assist in building a desirable framework. These should be carefully watched, and where the growth becomes too lengthy, shortened in to a lateral growth, and where laterals are not present headed back to the limits of the other growths. Heading back and thinning may be done when the growths have hardened, not when they are soft and growing rapidly. It is possible to check excessive growths by pinching out an inch or so of the tips.

The densely-growing habit of the mandarin, leading to a profusion of weak shoots, is responsible for overbearing and resultant small and inferior fruits at an early age. Providing that a well-developed framework has been maintained, young well-grown mandarin trees may be permitted to bear at four years of age. The annual pruning of bearing mandarin trees requires the same regular and close attention as in training and forming young trees. The dense growths and crowded branches require to be well thinned out and shortened back to vigorous laterals of current season growth, removing weak twigs and where possible shoots that have borne fruits. Such annual treatment permitting ample light and the ready circulation of air throughout—(1) greatly increases the vigour of the tree; (2) suppresses surplus growths and twigs; (3) improves the size and quality of the fruit; and (4) provides for the renewal of ample young and vigorous fruiting wood.

Plate 30.
Four-year-old Glen Retreat Mandarin.

LEMONS.

With lemons the general practice with growers has been to prune severely while the trees are young in an effort to control the growth and so produce a strong framework. In some instances such treatment has retarded growth, and certainly it has retarded the early fruiting of the trees. Apart from the necessary trimming at planting, which, similarly to oranges, consists of shortening back and removing broken and bruised roots, and a corresponding shortening back of the head of the tree in such a manner as to produce a strong straight stem with three or four

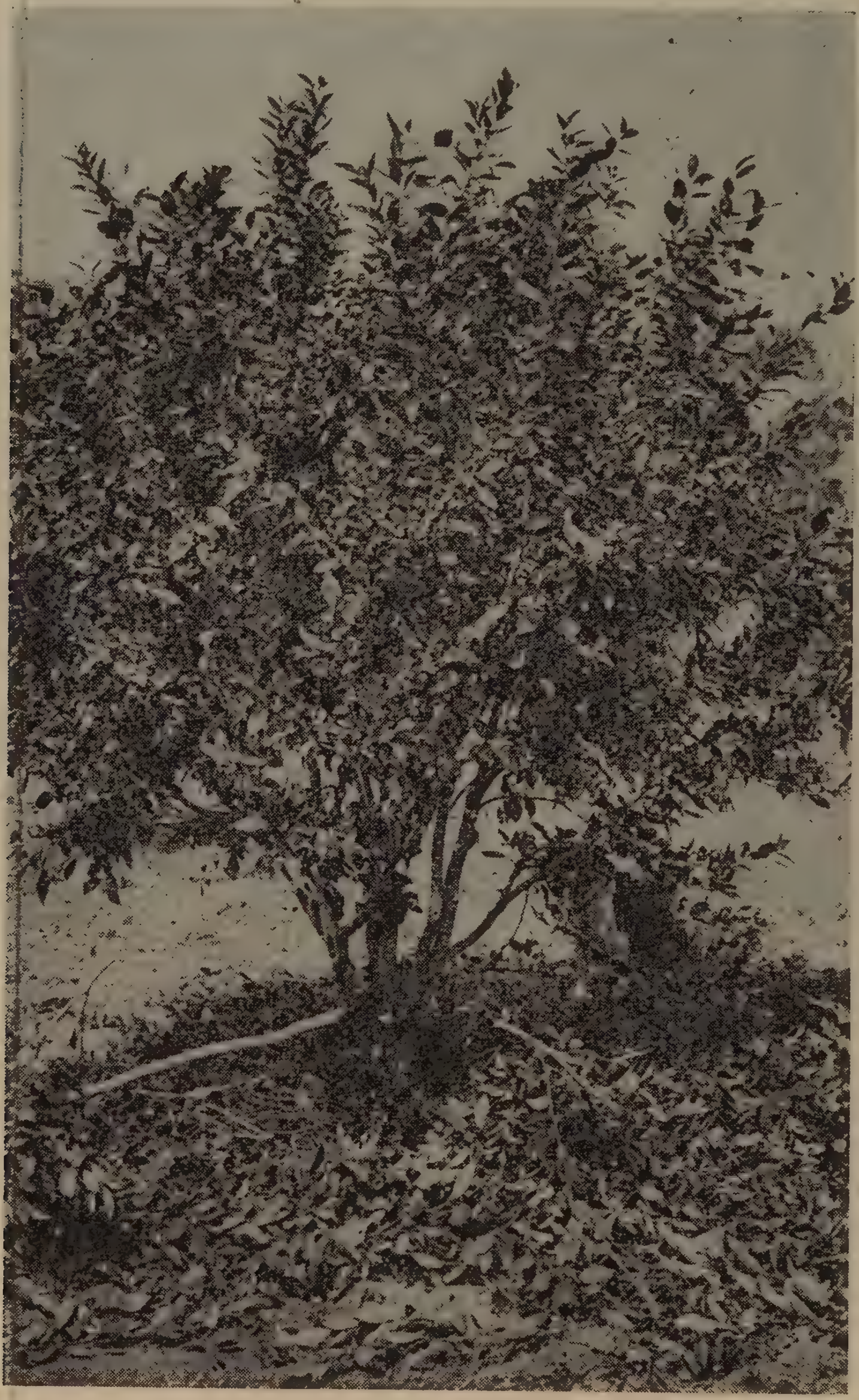

Plate 31.
Tree in Plate 30 after pruning.

well-placed arms radiating therefrom, little pruning should be done during the first two or three years. All that is necessary is a light thinning to remove any undesirable shoots that are out of place and would later upset the balance of the tree, and perhaps a shortening of excessively vigorous shoots. Main upright-growing limbs, evenly spaced, should be selected as main leaders. As the trees get older these become weighted down at the ends by subdivision, and the weight of fruit and strong side shoots will arise from them. These side shoots should be

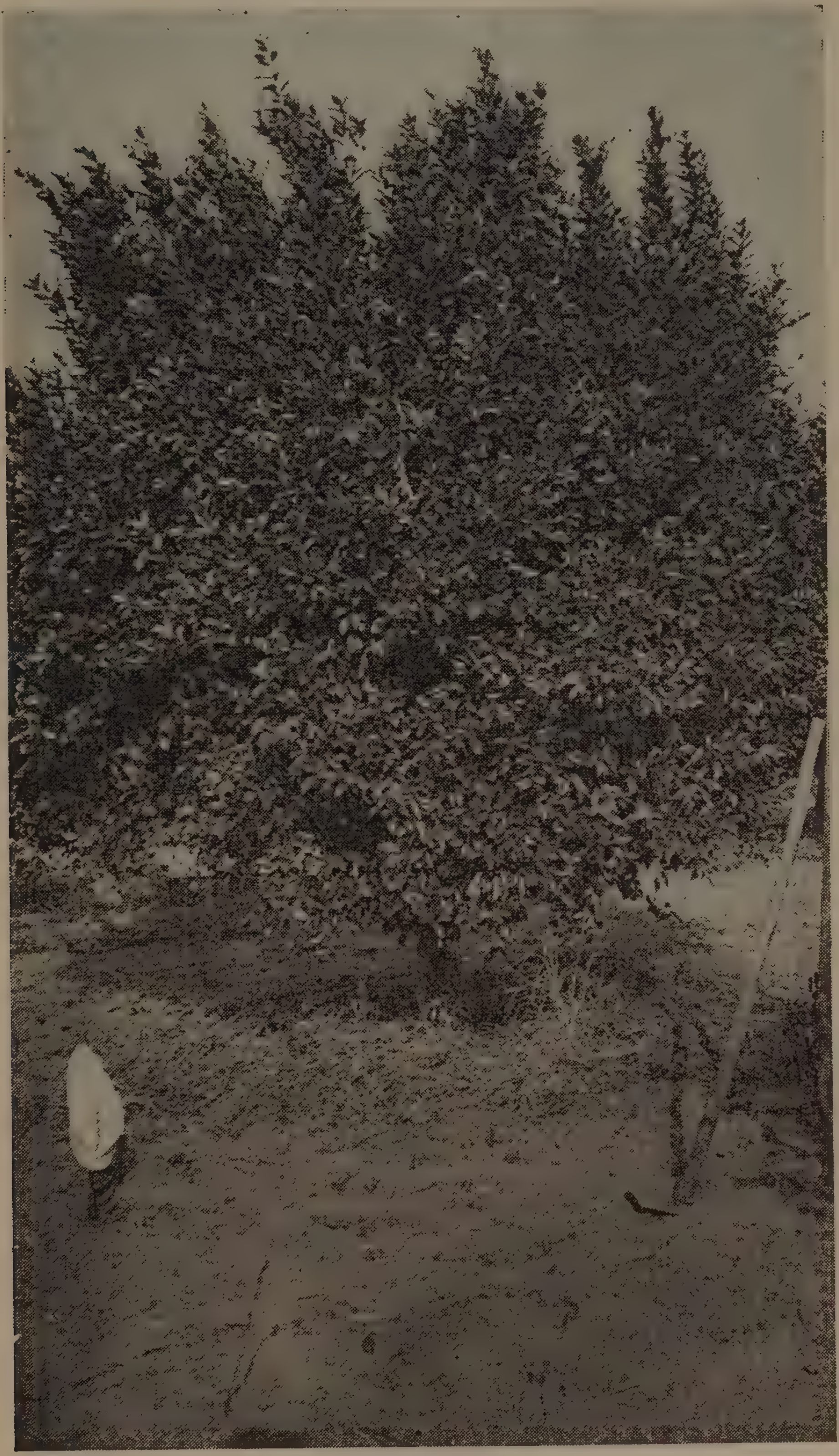

Plate 32.

Twelve-year-old Glen Retreat Mandarin before pruning.

thinned out, but not all removed. Those left should be shortened back to form spurs which will produce the best fruit. Suitable growths close to the centre of the tree may be left to grow upright and take the place of the first leaders which have been weighed down.

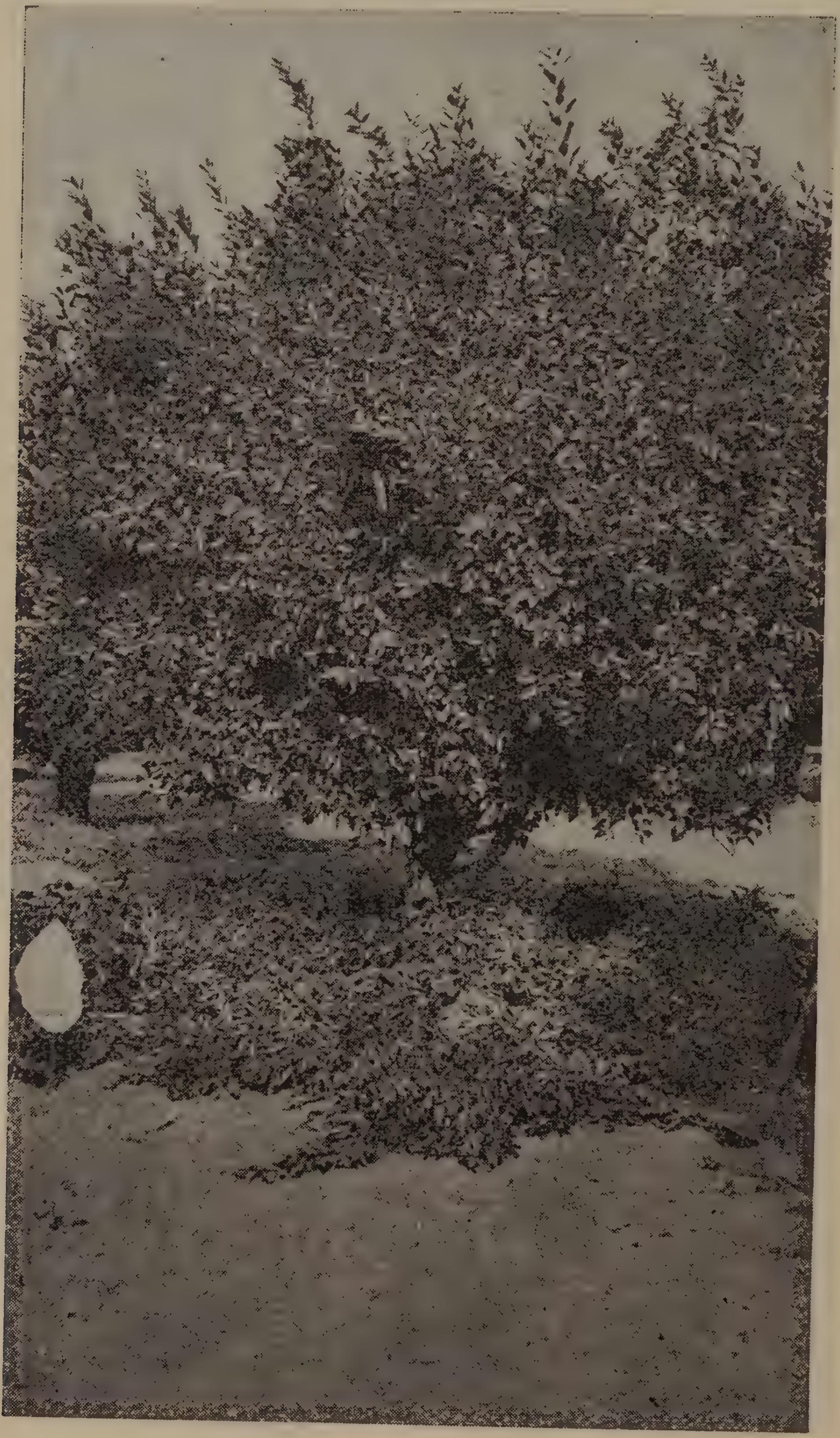

Plate 33.
Twelve-year-old Glen Retreat after pruning.

In time it will be found the tree is built up of series of tiered branches radiating from the main framework. The object of building up the tree in this manner and spurring it is to encourage a fruit-bearing habit. This is explained as follows:—As the fruit weighs the vertical branches down to a more horizontal position, the vigour of the branches is reduced, and side shoots arising from such branches are, when spurred as outlined above, conducive to fruit production.

When shortening side shoots, the cuts should be made well back into ripe wood, thus throwing the sap into dormant buds. Light wood issuing from inside the more erect permanent arms may be retained, shortening for spurring, and from time to time renewed. No rank growth should be tolerated unless it is required to continue the work of

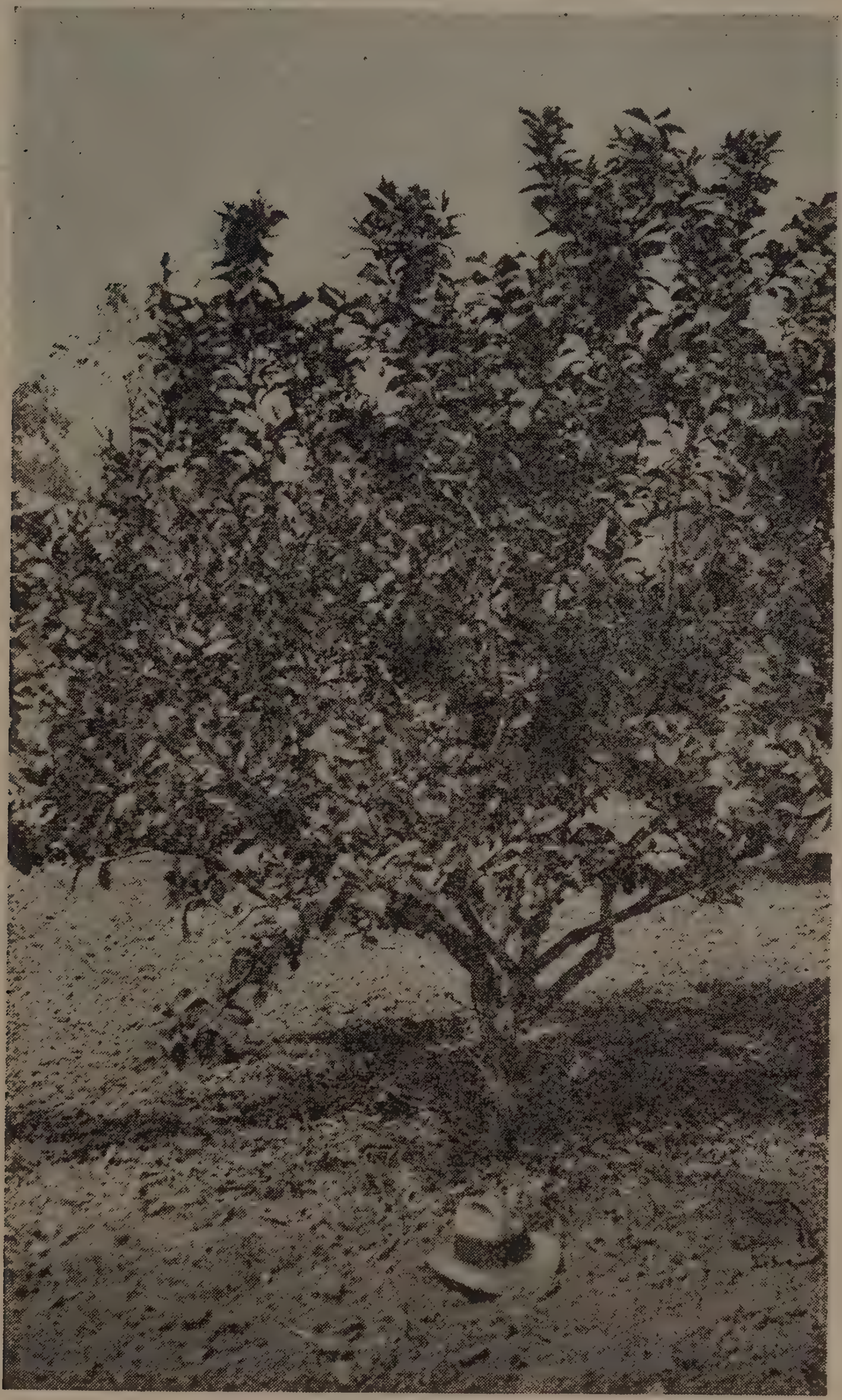

Plate 34.

Typical young lemon tree.

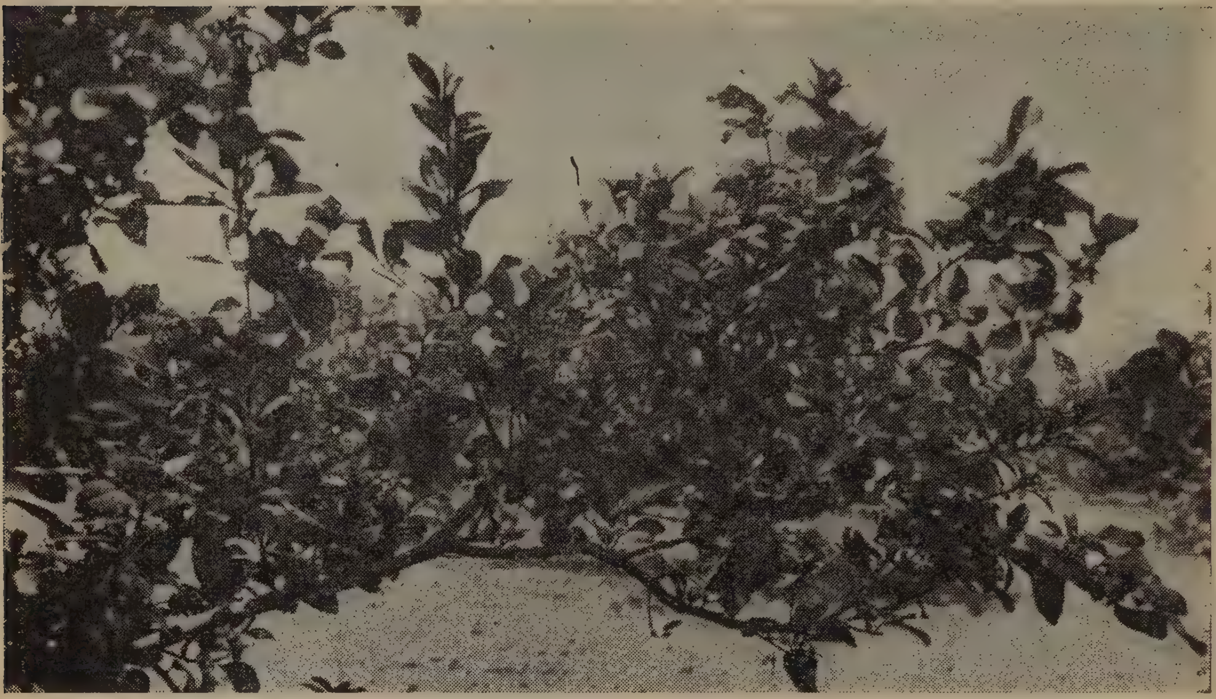

Plate 35.
Lemon leader weighted down. Note strong side shoots.

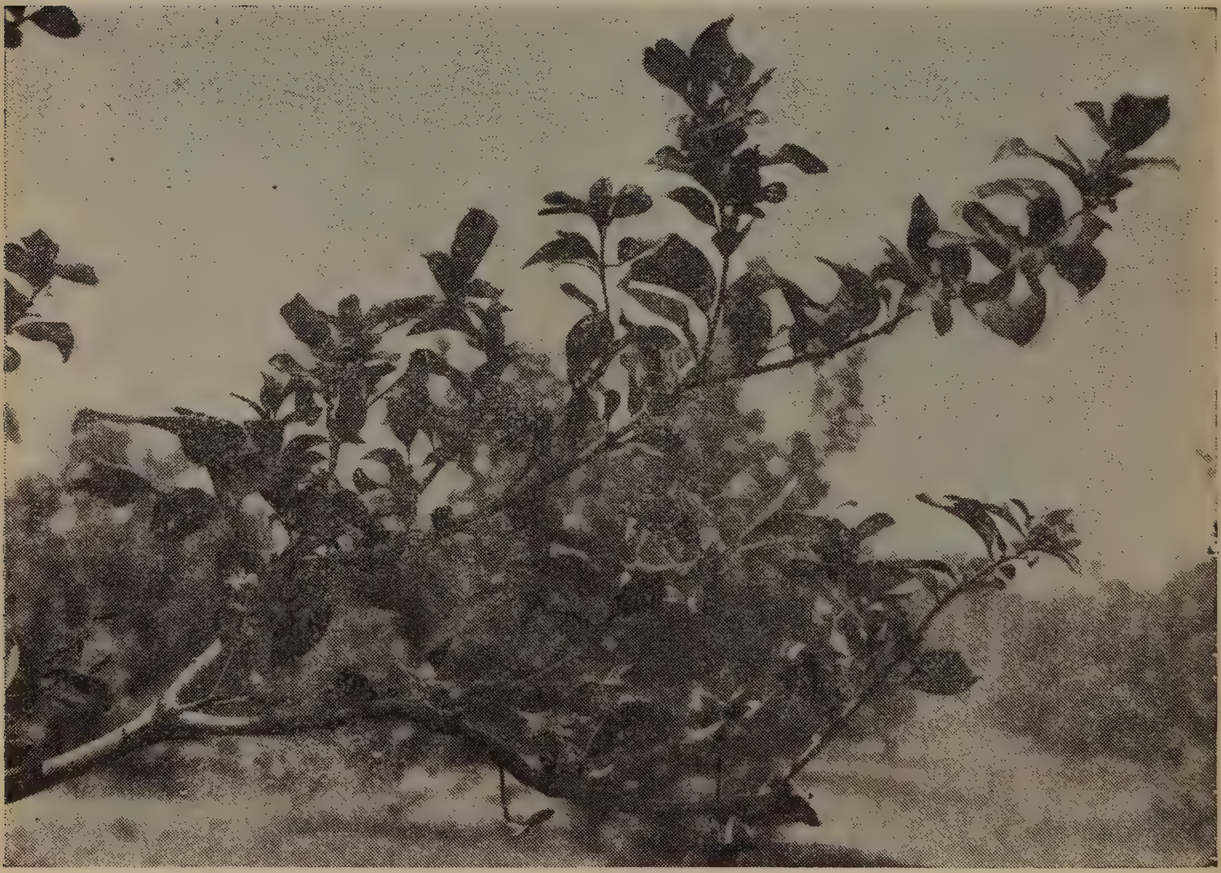

Plate 36.
The fallen leader shown in Plate 35 after thinning and shortening back the side shoots.

some displaced leader. As the limbs drag down it will be necessary from time to time to lift the tree by removing some of the lower limbs.

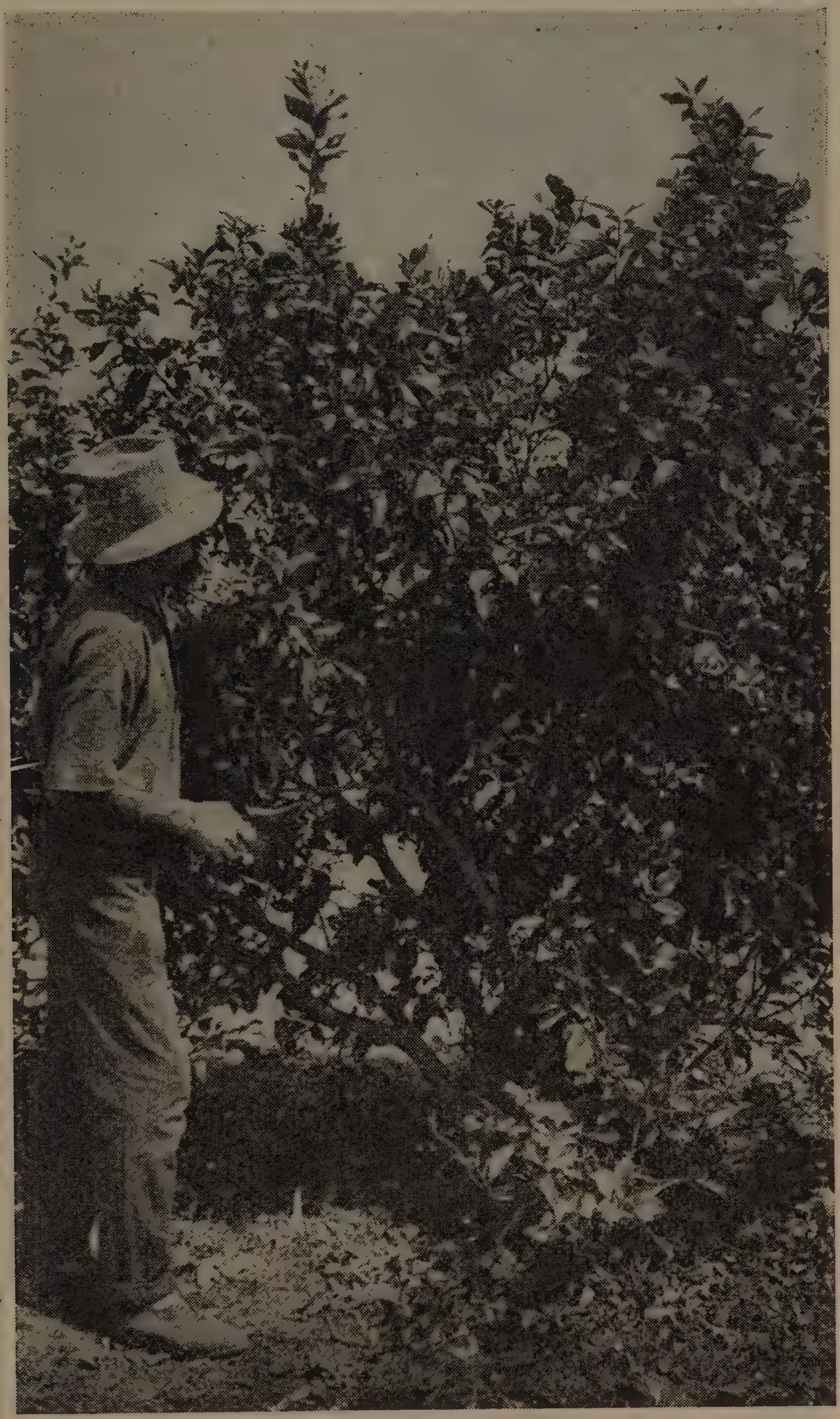

Plate 37.
Badly framed young lemon.

RENOVATING DECADENT TREES.

The renovating of many of our old citrus orchards which are rapidly failing in productivity and health constitutes a serious problem. The cause of the decline of citrus trees in Queensland is chiefly due to starvation together with a combination of climatic and soil conditions. The characteristics of decadent trees may be enumerated as follows:—

(1) Increased percentage of small-sized fruits.
(2) Decreased yield.
(3) Dwarfed foliage in the tree tops.
(4) Weak leafless fruiting wood.
(5) Heavy production of weak blossom.

Plate 38.

The same tree illustrated (Plate 37) after pruning.

There are numerous instances where many of our old and decadent trees may be profitably renovated. Several methods have been used in rejuvenating citrus trees—deheading (by which is meant the cutting back of the tree to three or four main arms to within 18 inches to 2 feet of the main stem); a modification of this in which the secondary branches are stubbed back to a foot or so in length. Both these methods are somewhat severe, as in removing the entire top of the tree, the balance is upset and the rooting system weakened. Skeltonising—a much less severe method—has now found favour and is giving satisfactory results.

Plate 39.

A decadent lemon tree.

The entire framework of the tree is generally left, except where crowded and diseased limbs require to be removed. Cross limbs and unnecessary leaders are cut out or shortened back. An entirely new fruiting system is built up from the remaining skeleton. The degree of severity of cutting back depends upon the condition of the tree. When declining trees are cut back in this manner, it should be remembered that the bark is very susceptible to sun scald and all the exposed limbs must be thickly coated with a suitable whitewash for protection. A simple whitewash formula can be made as follows:—

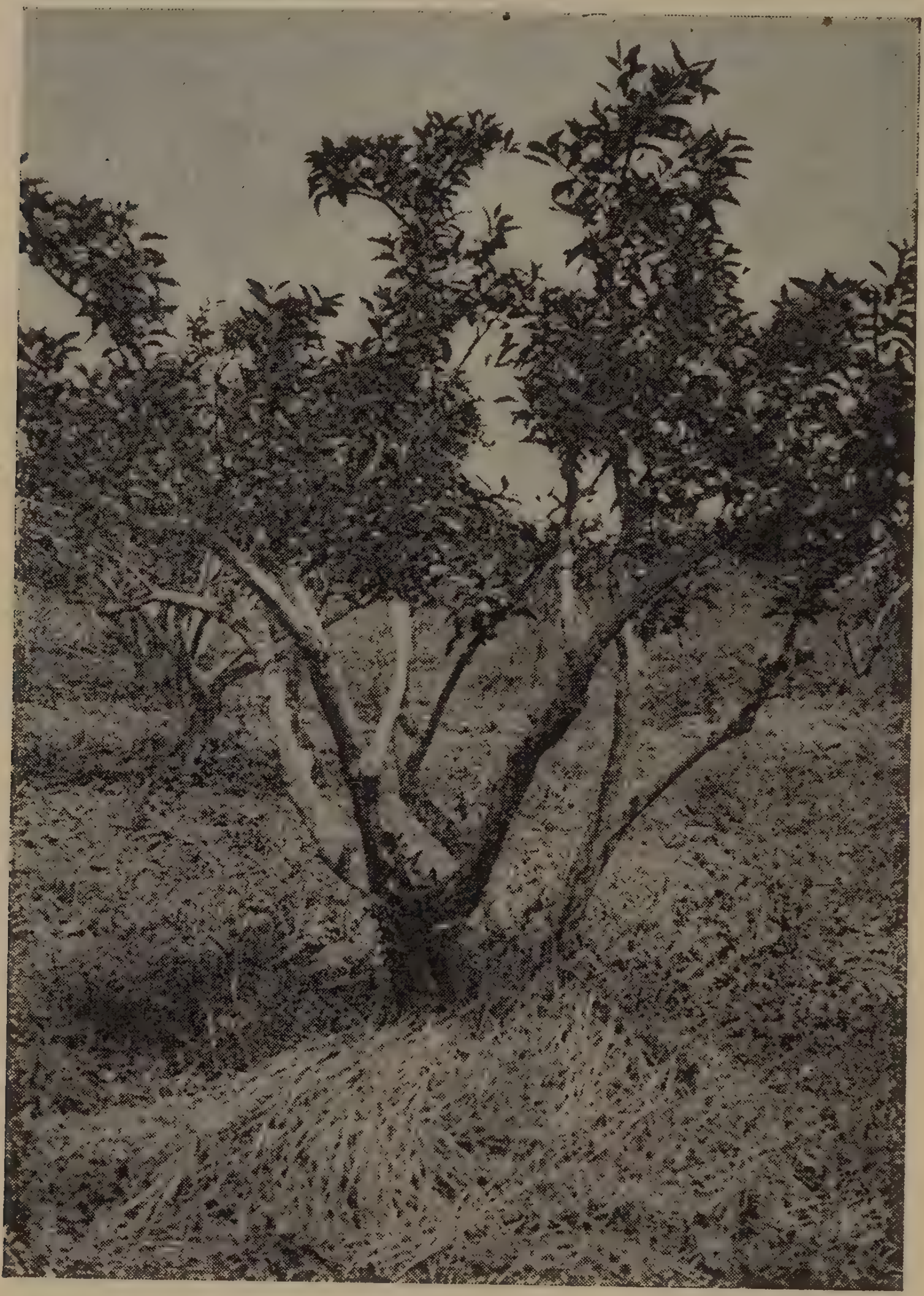

Plate 40.
The same tree shown (Plate 39) after pruning.

Quick Lime	7 lb.
Sulphur (powdered)	2 lb.
Salt, flour, or size	1 lb.

As the lime is slaked down, the sulphur and salt should be well stirred in, and sufficient water should be added to bring the mixture to the consistency of a good paint.

[TO BE CONTINUED.]

Lime for Agricultural Purposes.

F. B. COLEMAN, Officer in Charge, and R. A. TAYLOR, A.A.C.I., Inspector and Examiner, Seeds, Fertilizers, Veterinary Medicines, Pest Destroyers and Stock Foods Investigation Branch.

UNDER "*The Fertilisers Act of* 1935," lime for agricultural purposes is dealt with very comprehensively.

The classification set out in the Act with respect to the types of lime for agricultural purposes is as follows:—

(1) Burnt lime, caustic lime, or quicklime—consisting chiefly of lime in the form of calcium oxide (CaO); or

(2) Slaked lime, air-slaked lime, mild lime, hydrated lime—consisting chiefly of lime in the form of hydrate of lime ($CaOH_2$) and/or carbonate of lime ($CaCO_3$), obtained by the slaking of burnt lime; or

(3) Processed lime—consisting of a by-product from a process—chiefly lime in the form of hydrate and/or carbonate of lime; or

(4) Pulverised limestone, marble, coral, or shells—consisting chiefly of lime in the form of carbonate of lime ($CaCO_3$) obtained by crushing or pulverising; or

(5) Earthy lime—consisting chiefly of lime in the form of carbonate of lime ($CaCO_3$) obtained by excavation of the natural substance; or

(6) Gypsum—consisting of lime in the form of hydrated sulphate of lime ($CaSO_4.2H_2O$).

The classification of lime, as shown above, is based upon terms in common use, which describe the process of preparation or manufacture to which the limes concerned have been subjected.

Burnt Lime is obtained as follows:—

Limestone is first quarried and broken into pieces of suitable size. These pieces are placed in a kiln with fuel—in Queensland usually wood—which is ignited. The heat serves to liberate the carbon dioxide from the calcium carbonate, leaving calcium oxide and a quantity of impurities proportionate to the purity of the original limestone.

Pure limestone would contain 56 per cent. calcium oxide and 44 per cent. carbon dioxide; pure burnt lime would contain 100 per cent. calcium oxide. In actual fact the minimum purity of good burnt lime can be accepted as 90 per cent. calcium oxide (CaO). It should be emphasised that the impurities mentioned above, consisting of iron, alumina, magnesia, silica, &c., are naturally present in limestone, and cannot without great expense be removed; moreover, in normal proportions they do no harm and can be disregarded.

It is essential that the limestone should be completely burnt, otherwise the purchaser is buying some of the original limestone at the price of burnt lime.

An analysis of burnt lime indicates whether the limestone has been completely burnt; even if the burnt lime has been partially slaked it is still possible to determine this.

Burnt lime slakes under normal atmospheric conditions, taking in carbon dioxide and water from the air and "altering" from calcium oxide to a mixture of calcium hydroxide and calcium carbonate. This slaking may be considered in two steps:—

At first the calcium oxide alters to calcium hydroxide and calcium carbonate, with calcium hydroxide in much greater proportion than calcium carbonate.

An analysis would show, say—

50 per cent. calcium oxide (CaO) as calcium oxide.
30 per cent. calcium oxide (CaO) as calcium hydroxide.
4 per cent. calcium oxide (CaO) as calcium carbonate.

When the whole of the oxide has "altered," the proportions of the hydroxide and carbonate would be represented by, say—

0 per cent. calcium oxide (CaO) as calcium oxide.
60 per cent. calcium oxide (CaO) as calcium hydroxide.
10 per cent. calcium oxide (CaO) as calcium carbonate.

This slaked lime would then gradually "alter" until it becomes all carbonate, an analysis revealing, say—

55 per cent. calcium oxide (CaO) as calcium carbonate.

This is then a stable article, and undergoes no further change under atmospheric conditions.

Following on the above, it may be assumed that an analysis of—

50 per cent. calcium oxide (CaO) as calcium oxide,
30 per cent. calcium oxide (CaO) as calcium hydroxide,
4 per cent. calcium oxide (CaO) as calcium carbonate.

represents a well-burnt lime that has partially air-slaked.

An analysis such as the following, however, would indicate by the excess of calcium carbonate, compared with calcium hydroxide, the presence of unburnt calcium carbonate, and consequently could be assumed as being a partially-slaked, badly burnt lime:—

50 per cent. calcium oxide (CaO) as calcium oxide.
7 per cent. calcium oxide (CaO) as calcium hydroxide.
22 per cent. calcium oxide (CaO) as calcium carbonate.

Of course the following—

70 per cent. calcium oxide (CaO) as calcium oxide,
0 per cent. calcium oxide (CaO) as calcium hydroxide,
16 per cent. calcium oxide (CaO) as calcium carbonate,

is obviously a freshly-prepared, badly burnt lime.

It must be noted that the percentages given are *calcium oxide* (CaO),—not calcium hydroxide ($Ca(OH)_2$) or calcium carbonate ($CaCO_3$).

When a farmer realises that burnt lime slakes under normal atmospheric conditions, and its percentage of calcium oxide (CaO) and its neutralising value become lower, it is easy to see that burnt lime should be packed and railed as *freshly burnt* material. If the material has started to slake before being packed and weighed, the purchaser is buying and paying freight on partially slaked lime, which, as above stated, has a lower percentage of lime (CaO) and lower neutralising value.

Thus, a person who pays for burnt lime and asks the manufacturer to slake it for him, unless he gets the *increased "weight equivalent"* of slaked lime, is losing badly on the proposition; in any case he is paying freight on carbon dioxide and water that could be added to the burnt lime on his own property.

Burnt lime should be purchased on the basis of net weight at the place of burning—which in North Queensland is usually some distance from the coast—as, during transit to the coast, an increase in weight could occur (due, as above stated, to taking up of carbon dioxide and moisture) before weighing; if weighed at the coast this increase would be included in the net weight charged for. In other words, 10 tons of burnt lime at the kilns could weigh 11 tons on the coast, with a consequent increased cost to the purchaser.

Ground Burnt Lime is, as its name indicates, burnt lime that has been pulverised by machine without first slaking. One such product is now being offered for sale in Queensland.

The farmer in this case must weigh the additional cost of the material against any advantage in fineness, taking into consideration the facts that although he can easily slake unground burnt lime on his own property, there is no additional freight cost (as with slaked lime) involved with ground burnt lime, providing it is bagged and railed immediately.

Of course the fine state of division would accelerate slaking considerably, and this would not be apparent from appearance—as the original material is already in a fine state.

Slaked Lime, as stated above, is usually obtained by air-slaking—that is, exposing burnt lime to the slaking effects of the atmosphere. A more rapid slaking can be obtained by sprinkling with water; this produces a rapid chemical change, with evolution of heat, and results in a fine, white powder, termed water-slaked or hydrated lime.

With a correctly-made water-slaked lime the amount of water added is about one-third of the weight of the original burnt lime; the resultant product should be practically all calcium hydroxide, and should give a minimum analysis of 70 per cent. calcium oxide (CaO) as calcium hydroxide.

Possibly owing to lack of experience in this method of slaking, and the necessity for careful control with respect to proportions, &c., in order to obtain a "consistent" product, water-slaked lime for agricultural purposes can be stated to be practically absent from the Queensland market.

The slaked lime made by farmers from burnt lime is commonly air-slaked lime.

Of course, water-slaked lime on exposure will gradually alter to air-slaked lime, changing in time from practically pure calcium hydroxide to practically pure calcium carbonate.

The proportion of calcium oxide present and the forms in which it occurs at the time of application to the soil vary with the progress made in the process of slaking; this, of course, causes complications with respect to the amount of lime to be applied.

If burnt lime is purchased, the purchaser should apportion the lime actually applied to the soil into the same number of units as he planned for the original burnt lime.

For instance:—

A farmer buys 10 tons of burnt lime with a neutralising value of 160, planning to apply $\frac{1}{2}$ ton per acre to 20 acres.

When slaked ready for use the total weight may have increased to, say, 12 tons.

The neutralising value will be *reduced* by the slaking.

The lime should still be divided into twenty lots and applied as planned, but the actual weight per acre will now be $\frac{12}{10} \times \frac{1}{2} = \frac{12}{20}$ ton $=$ 12 cwt. instead of 10 cwt.

The actual weight of calcium oxide (CaO) applied to the soil will be the same, however.

This is demonstrated thus:—

10 cwt. x neutralising value 160 = 1,600

12 cwt. x neutralising value 133$\frac{1}{3}$ = 1,600

The neutralising value bears an approximate ratio to the calcium oxide (CaO) percentage.

There is not much of any slaked lime sold as slaked lime in Queensland; as will be seen, only one is registered.

Processed Lime.—In certain industries lime (usually burnt lime) is used in chemical processes, and a resultant lime by-product is obtained. In Queensland, only one lime of this type is offered for sale; when freshly run-off in paste form it contains calcium hydroxide and calcium carbonate, but on being spread out in the open the hydrate gradually alters to carbonate. The final product, when dried, is ground, and constitutes a recognised lime for agricultural purposes.

Pulverised Limestone, Pulverised Marble, Pulverised Coral, or *Pulverised Shells* are the respective natural materials after treating by passing through a crushing or pulverising machine.

The percentage of calcium oxide varies according to the purity of the original material; the calcium oxide is in the form of calcium carbonate. *Pulverised limestone* varies in quality, but, generally speaking, is a fairly high-grade source of lime. It must be ground in a pulverising machine, as is explained elsewhere under the heading of "*Fineness.*"

The degree of fineness is an important factor governing its value. The natural impurities usually present are chiefly magnesia, iron, alumina and silica.

Earthy Lime consists of lime carbonate which is in a naturally disintegrated or friable condition, and is dug out after removal of the "overburden." It is comparatively impure and of a softer nature than limestone. It needs very little treatment before being offered for sale; sieving is usually sufficient to obtain a satisfactory degree of fineness—to which importance should be attached.

The calcium oxide content varies according to the purity of the material—as in pulverised limestone—and is wholly present in the form of calcium carbonate.

Earthy lime should always be screened before being bagged ready for sale.

Magnesian or Dolomitic Lime Carbonates.—A number of natural limestone deposits contain an appreciable quantity of magnesia. When this type of material is marketed in Queensland the maximum percentage of magnesia (MgO) must be declared on the label for the information of the purchaser, who may decide from this percentage whether the product is suited for his particular purpose or otherwise. Reference to the table of registrations will show that one magnesian lime for agricultural purposes is at present on the Queensland market. In this particular instance the material occurs as an earthy lime which requires very little pulverising.

Of course, practically all naturally occurring lime carbonates contain a small amount of magnesia.

It should be noted that the maximum percentage stated on the label refers to magnesia (MgO)—not magnesium carbonate ($MgCO_3$). This is comparable to the declaration of the percentage of calcium oxide (CaO) and not calcium carbonate ($CaCO_3$), as explained under "*Labelling.*"

Gypsum.—Gypsum is a naturally occurring form of lime, and may be described as dihydric calcium sulphate ($CaSO_4.2H_2O$).

It is very little used in Queensland, and although it has a minimum lime content of 32 per cent., it has no actual neutralising value.

No material is registered in Queensland under this name.

Miscellaneous Limes.—From time to time limes for agricultural purposes are placed on the market that owing to the quality of the material used, or difficulties involved in the process of manufacture or preparation, or other factors, do not compare with limes in the group to which they purport to belong.

In these cases they are classified as miscellaneous to allow purchasers to value them on their own merits apart from any group in which they would appear out of line.

Neutralising Value.—This term applies to all limes for agricultural purposes, except gypsum, and affords a means of comparison applicable to these limes.

It is a comparative figure which denotes the ability of the lime in question to neutralise acidity, which is one of the main purposes for which lime is used.

It is a figure ascertained practically, and would include any other carbonates or basic materials present.

The standard of comparison is 100 per cent. pure calcium carbonate, which would have a neutralising value of 100.

Comparative neutralising values would be:—

Burnt lime	160
Slaked lime	120
Pulverised limestone	90
Processed lime	86
Earthy lime	80

Fineness.—With respect to lime sold for agricultural purposes, fineness is of importance with earthy lime, pulverised limestone, pulverised marble, and other pulverised carbonates, and also processed lime.

"Fine" means particles that will pass a sieve with apertures $\frac{1}{100}$ inch square.

The whole of the limes to which fineness applies must pass a sieve with apertures $\frac{1}{8}$ inch square.

Burnt lime is not affected by fineness, and the resultant slaked lime is also exempt from this provision.

Carbonates with equal neutralising values may be compared on a fineness basis.

The reason why fineness applies to earthy lime, processed lime, pulverised limestone, and other pulverised carbonates, and not to burnt or slaked lime, may be set down as follows:—

It has been repeatedly proved *that lime carbonates, unless in a fine state of division, are not rapidly absorbed by the soil, being insoluble in pure water and only slowly soluble in slightly carbonated water—that is, water containing carbon dioxide in small quantity.

Artificial grinding (or screening) is therefore necessary with these materials.

Burnt lime, however, is in large lumps when sold, and of its own accord breaks down on slaking—either artificial or natural—to a fine powder. This powder, being usually largely hydroxide when applied, is fairly water-soluble, and is absorbed readily by the soil.

No artificial grinding is therefore necessary, and a fairly uniform absorption by the soil is obtained from all burnt or freshly slaked limes.

The table on page 99 sets out the various limes being offered for sale within the State.

The Value of Group Names.—The use of names indicating the groups to which the particular limes relate is of importance.

For instance, a purchaser uses the name "Burnt Lime." Now, providing names used are a correct indication, any burnt lime registered would have a neutralising value that should be associated with burnt lime, e.g., say, at least 160.

If he orders a pulverised limestone, irrespective of "specific designation," he would get a material with a neutralising value of, say, at least 90, and with earthy lime, say, 70 to 90.

In addition, with the use of the name "Burnt Lime," he can dispense with fineness, whereas, with pulverised limestones, earthly limestones, &c., he has two factors of importance—neutralising value and fineness.

In short, limes may readily be compared with other limes in their own respective groups, and the strict adherence to this grouping with respect to the names used on the labels is of importance in allowing this comparison to be easily made.

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* "Value of Different Forms of Lime," by Dr. H. W. Kerr and C. R. von Stieglitz, Farm Bulletin No. 6, Bureau of Sugar Experiment Stations.

LIMES FOR AGRICULTURAL PURPOSES.

Registered under the Fertilisers Act of 1935 for the year ending 31st December, 1936.

Name and Address of Dealer.	Brand.	Guaranteed Analysis. Calcium Oxide (CaO).	In the under-mentioned Form.	Neutralising Value.	Magnesia (MgO) as Magnesium Carbonate.	Fine.	Coarse.
		Minimum %		Minimum.	Maximum %	Minimum %	%
Burnt Lime—							
Ambrose Lime Works, Ambrose	Ambrose	90	As oxide	160	..	..	..
Crotty Lime Works, Ootann Siding, via Cairns	Crotty	90	As oxide	160	..	..	..
Demchok, M., Mungana	Mungana	90	As oxide	160	..	..	..
Ryan Lime Co. (Pty.) Ltd., Townsville	Ryan	90	As oxide	160	..	..	..
Tamaree Lime Works, Tamaree	Tamaree	90	As oxide	160	..	..	..
Webb & Son, Reid River, N.Q.	Webb's	90	As oxide	160	..	..	..
Burnt Lime (Pulverised)—							
Ryan Lime Co. (Pty.), Ltd., Townsville	Ryan	85	As oxide	150	..	..	..
Slaked Lime—							
Ambrose & Sons, H., Tamaree	Tamaree	5 45 11	As oxide As hydroxide As carbonate	120	..	..	..
Processed Lime—							
A.C.F. & Shirleys Fertilizers Ltd., Brisbane	A.C.F. Hydrolime	47	As carbonate	88	..	50	50
Australian Chemical Co. Ltd., Brisbane	Acco	47	As carbonate	88	..	50	50
Pulverised Limestone, Marble, &c.—							
Ambrose Lime Works, Ambrose	Ambrose	50	As carbonate	90	..	84	16
Crotty Lime Works, Ootann Siding, via Cairns	Crotty	51	As carbonate	92	..	77	23
Gibbs, Bright, & Co., Brisbane	S.C.	50	As carbonate	91	..	60	40
Marberete Co., Valley, Brisbane	Marberete	55	As carbonate	99	..	44	56
Ryan Lime Co. (Pty.) Ltd., Townsville	Ryan	50	As carbonate	90	..	50	50
Earthy Lime—							
Breen & Olsen, Marmor Lime Works, Marmor	Breen & Olsen	51	As carbonate	90	..	70	30
Bryant C. J., Didcot, Gayndah Line	Didcot	47	As carbonate	80	..	74	26
Ryan Lime Co. (Pty.) Ltd., Townsville	Ryan	45	As carbonate	80	..	30	70
Webb & Son, Reid River, N.Q.	Webb's	45	As carbonate	80	..	30	70
Containing Magnesia—							
Inkerman Lime Co., Inkerman	Inkerman	43	As carbonate	85	7	60	40

Fine means particles that will pass a seive with 1/100″ square apertures.

Labels.—The method of labelling lime with respect to lime content (as indicated also in the Table) is as follows:—

The percentage or percentages of calcium oxide (CaO) and the respective forms in which it occurs must be stated. This means that, with slaked limes or carbonates, not the percentage of calcium hydrate and percentage of calcium carbonate should be stated, but the percentages of calcium oxide (CaO) that are present in each of those forms.

Let us take a partially air-slaked lime for an example. This may consist actually of—

50 per cent. calcium oxide,
40 per cent. calcium hydroxide, and
5 per cent. calcium carbonate,
with, say, 5 per cent. impurities.

Now, in the calcium hydroxide and calcium carbonate, only the percentages of calcium oxide (CaO) can be called active constituents.

To compare with burnt lime containing, say, 90 per cent. calcium oxide (CaO), all as calcium oxide, this lime must be reduced to a common basis. In other words, to compare with a material that has lime present only as calcium oxide (CaO), the percentages of calcium hydroxide and calcium carbonate must also be reduced to the amount of calcium oxide (CaO) that they contain—the forms in which the calcium oxide (CaO) occurs being, of course, also stated.

Thus, the label would read—

50 per cent. calcium oxide (CaO) as calcium oxide
30 per cent. calcium oxide (CaO) as calcium hydroxide
2·8 per cent. calcium oxide (CaO) as calcium carbonate

Total 82·8 per cent. calcium oxide (CaO).

On this figure the material can then be compared with any other lime on a total calcium oxide (CaO) basis.

Of course, the neutralising value gives a definite method of comparison, but it includes magnesia and other neutralising material, and is a comprehensive figure only; also, of course, the neutralising value does not indicate the form or forms in which the calcium oxide occurs, and is of value only with respect to neutralising soil acidity.

It is provided by the Fertilisers Act that all limes for agricultural purposes shall be labelled in such a manner as to set out:—

The kind of lime;
The percentage of calcium oxide (CaO) and the form or forms in which it occurs;
The neutralising value;
The net weight;
The percentage of fineness (except in the case of lime which has been burnt); and
The name and address of the manufacturer or dealer.

The following sets out examples of labels:—

BURNT LIME FOR AGRICULTURAL PURPOSES.
When packed, lb. net.
90 per cent. Calcium Oxide (CaO) as Calcium Oxide.
Neutralising Value, 160.
(Name and Address of Manufacturer or Dealer.)

PULVERISED LIMESTONE FOR AGRICULTURAL PURPOSES.
When packed, lb. net.
50 per cent. Calcium Oxide (CaO) as Calcium Carbonate.
Neutralising Value, 90.
Fine, 80 per cent. Coarse, 20 per cent.
(Name and Address of Manufacturer or Dealer.)

EARTHY LIME FOR AGRICULTURAL PURPOSES.
When packed, lb. net.
45 per cent. Calcium Oxide (CaO) as Calcium Carbonate.
Neutralising Value, 80.
Fine, 65 per cent. Coarse, 35 per cent.
(Name and Address of Manufacturer or Dealer.)

MAGNESIAN EARTHY LIME FOR AGRICULTURAL PURPOSES.
When packed, lb. net.
43 per cent. Calcium Oxide (CaO) as Calcium Carbonate.
7 per cent. Maximum Magnesia (MgO) as Magnesium Carbonate.
Neutralising Value, 85.
Fine, 60 per cent. Coarse, 40 per cent.
(Name and Address of Manufacturer or Dealer.)

This article deals only with the legislation controlling the sale and quality (both chemical and physical) of the various limes for agricultural purposes, that are sold within this State.

Any information desired as to the actual use or application to the land for specific purposes should be directed to the other branches of the Department that are concerned.

Summary.

The chief original source of lime for agricultural purposes in Queensland is limestone rock.

The principal kinds of lime derived from this are as follows:—

Burnt Lime.—This is made by burning lumps of limestone, and providing it is packed and railed when freshly burnt, is a ''concentrated'' source of lime. It is to the farmer's advantage to slake burnt lime on his own property.

An average quality burnt lime should analyse—

90 per cent. calcium oxide (CaO) as calcium oxide, and neutralising value, 160.

Burnt lime is used in certain chemical processes; the resultant by-product is known as *Processed Lime,* and contains the calcium oxide (CaO), chiefly in the form of carbonate.

An average quality processed lime should analyse:—

46 per cent. calcium oxide (CaO) as calcium carbonate, neutralising value, 86; fine, 50 per cent.; coarse, 50 per cent.

Pulverised Limestone is the original rock quarried and ground. An average quality material should analyse:—

50 per cent. calcium oxide (CaO) as calcium carbonate, neutralising value, 90; fine, 80 per cent.; coarse, 20 per cent.

Other important limes for agricultural purposes are:—

Earthy Lime, which is an impure form of lime carbonate that can easily be worked by digging, being softer than limestone, and usually requiring screening only. An average quality material should anlayse:—

45 per cent. calcium oxide (CaO) as calcium carbonate, neutralising value, 80; fine, 65 per cent.; coarse, 35 per cent.

Magnesian Limes for Agricultural Purposes, which are pulverised limestones or earthy limes containing appreciable quantities of magnesia.

The maximum percentage of magnesia (MgO) as magnesium carbonate must be declared on the label, and this should be considered by the farmer with a view to the application of the material for particular purposes.

Efficiency of Lime for Agricultural Purposes.—Limes which have been burnt may be compared on a neutralising value basis only.

Other forms of lime may be compared within their own respective groups on a neutralising value and fineness basis.

Labels should set out the—

Kind of lime,

The percentage of CaO and forms in which it occurs,

The neutralising value,

The net weight,

The fineness (unless prepared by burning),

The name and address of the manufacturer or dealer.

Buyers of lime of a greater value than 10s. should receive an invoice bearing the warranty required by the Act with respect to the quality of the article.

On no account should purchasers accept delivery of lime for agricultural purposes that is not labelled and invoiced in the manner outlined above.

All complaints or inquiries should be addressed to the Seeds, Fertilizers, Veterinary Medicines, Pest Destroyers, and Stock Foods Investigation Branch, Department of Agriculture and Stock, Brisbane.

REGISTERED STALLIONS.

Subjoined is a list of stallions in respect of which Certificates of Registration were issued under "*The Stallions Registration Acts,* 1923 *to* 1934," during the year 1936-37:—

BLOOD STALLIONS CERTIFICATED FOR LIFE DURING YEAR 1936-37.

Name.	No.	Age.	Description.	Owner.
Admontem	1710	Aged	Chestnut	J. Allingham, Kangaroo Hills, Ingham
Aladdan	1498	6	Grey	N. G. Walker, Iveragh
Astor King	1688	5	Bay	R. Stark, M. P. Creek, Wondal
Ben Art	1423	5	Chestnut	A. G. Anderson, Hendra
Bernfield	1711	Aged	Brown	M. Meehan, Toonpan
Bill Savin	1689	6	Iron grey	W. L. Wieckhorst, Tingoora
Black Guard	1243	6	Black	R. Betts, Boonah
Bollitree	1418	5	Bay	R. De la Bere Hill, Unumgar
Boystock	1712	Aged	Bay	A. Cox, Ayr
Brutus	1618	6	Brown	S. S. Webb, Toowoomba
Bubble	1492	5	Bay	J. B. Shannon, Tooloombah
By Golly	1690	5	Brown	F. Cockrell, Archookoora
Cavalier	1378	6	Bay	R. J. D'Arcy, Glenrock, Gatton
Chieftain	1691	5	Iron grey	Hunter Bros., Cinnabar
Cottingham	1408	Aged	Chestnut	H. T. Sheppard, Greenbank
Denis Lad	1411	6	Chestnut	G. E. Crane, Elbow Valley
Diamond	1427	6	Bay	W. Gunn, Goondiwindi
Don Pride	1692	5	Brown	C. Svenson, Bundaberg
Duinatic	1693	5	Bay or brown	J. Drinan, Wallaville
Dux	1619	5	Brown	R. Fawcett, Toowoomba
Emblem Mat	1695	5	Iron grey	W. Elsebach, Gayndah
Embleso	1696	5	Brown	L. Wedemeyer, Eidsvold
Falling Star	1458	5	Brown	A. C. Williams, Homevale, Nebo
Father's Footsteps	1420	5	Brown	Miss D. O'Neill, Lisson Grove, Clayfield
Flavic's Son	1459	6	Brown	W. G. Ney, Nebo
Frolic	1460	5	Brown	E. L. G. Johnson, Orkabie
Gaine Carrington	1425	Aged	Chestnut	T. Jennings, Greenmount
Glengarry	1493	5	Brown	W. C. Dickinson and Sons, Boynedale
Glenlock	1461	Aged	Brown	Cook and Cook, Wandoo, Koumala
Glen's Spear	1416	5	Brown	G. Cameron, Marian, Mackay
Gold Dust	1713	6	Bay	A. R. Foot, Reid River
Goldie	1379	Aged	Chestnut	W. E. Houston, Blackbutt
Gold Syce	1697	5	Chestnut	D. V. Wagner, Aranbanga, Gayndah
Gun Mark	1428	5	Black	T. Phelan, Gladfield
Hastate	1417	5	Bay	W. A. Collins, Cairns
Herriot	1714	Aged	Bay	Estate J. S. Love, Egera, Charters Towers
Imitate	1415	5	Brown	E. S. Cox, Upper Paddington
Jimsard	1462	Aged	Chestnut	W. J. Edwards, Mirani West
Kentabie	1698	5	Brown	P. J. Bishop, Mundubbera
Kerbat	1494	Aged	Brown	T. H. Craig, Broseley, Miriam Vale
Kildare	1463	Aged	Brown	D. W. Blyth, Koumala
King Emblem	1699	5	Brown	C. E. Pascoe, Ceratodus
King John	1715	Aged	Bay	Queensland Stud Limited, Wandovale
Knight Gold	1716	Aged	Bay	C. Schultz, Woodhouse, Ayr
Ladowee	1717	5	Brown	C. B. MacPherson, Mingela
Le Cornett	1718	Aged	Chestnut	Mrs. F. Calcott, Low Holm, Pentland
Lord Poitrel	1719	Aged	Bay or brown	Trustees J. Allingham, Hillgrove, Charters Towers
Major Hardy	1380	Aged	Bay	P. A. Peach, Upper Tent Hill
Mane Berd	1429	6	Bay	R. Devlin, Mill Hill
Master Persse	1381	5	Chestnut	E. J. Griffiths, Mount Forbes
Meloa	1720	Aged	Chestnut	T. Naughton, Broughton, Charters Towers
Menelaus	1700	5	Brown	Mrs. J. B. Salter and Sons, Biggenden
Mikado	1701	6	Bay or brown	G. R. Briggs, Swindon, Mount Perry
Moon Mirror	1497	5	Chestnut	G. Cunningham, Lion Mountain, Rockhampton
Mount Lad	1620	5	Grey	A. D. Orr, Aubigny
Mr. Singer	1382	5	Bay	P. Tuite, Toogoolawah
Nappatarra	1430	Aged	Bay	Leonard and Sons, Welltown
Oddenda	1621	6	Brown	P. T. Dwyer, Maclagan
Oratory	1722	Aged	Brown	A. W. Fadden, Executor Estate J. S. Love, Townsville
Orb	1464	5	Bay	E. G. Lascelles, Proserpine
Othello	1721	Aged	Bay	A. Shepherd, Milray, Pentland
Pan Yan	1723	Aged	Brown	S. Vaughan, junr., Bohle River
Playbox	1465	5	Grey	A. C. Williams, Homevale, Nebo
Pommy	1725	Aged	Bay	B. Anning, Cargoon
Prince Kerman	1431	Aged	Bay	P. J. Brosnan, Kooreela, New South Wales
Prince Orange	1622	5	Chestnut	D. Wormwell, Athlone, Meandarra
Robemond	1422	5	Black or brown	R. Baker, Caboolture
Saint Hero	1623	5	Chestnut	J. A. Bridge, Tara
Sarauda	1495	5	Chestnut	P. J. Hanrahan, Gogango
Serlodi	1424	6	Brown	W. H. Reynolds, Hamilton, Brisbane
Showfelt	1624	5	Brown or black	J. L. Thompson, Brookstead
Sinclair	1383	6	Bay	G. McLean, Esk
Sir Dignity	1433	5	Chestnut	Rae and Doyle, Bungunya
Sir Force	1434	5	Bay	A. G. Rowling, Texas
Sir Monarch	1421	5	Brown	T. Jennings, Greenmount
Song Time	1724	Aged	Chestnut	Estate of J. S. Love, Egera, Charters Towers
Sonny Boy	1702	Aged	Bay	A. M. Deighton, Gympie
Sonny Boy	1409	6	Bay	A. C. Corrie, Oxley

Blood Stallions Certificated for Life During Year 1936–37—*continued.*

Name.	No.	Age.	Description.	Owner.
Stout Fella	1436	Aged	Bay	C. Webster, Newinga, Talwood
St. Stephen	1432	5	Chestnut	Wright and Sons, Goondiwindi
Sunshine	1625	5	Bay	A. R. Curd and Sons, Jandowae
Thalacre	1626	6	Bay	R. W. Jahnke, Rywung
Tooloomba	1496	5	Brown	J. W. Mylrea, Canoona
Townie	1703	Aged	Bay	S. B. Trigger, Lakeside
Treken	1410	5	Chestnut	G. F. Scott, Beaudesert
Turkish Prince	1704	5	Brown	E. Zillman, Wallaville
Vertibra	1726	Aged	Black	Mrs. A. Black, Jajingo, Charters Towers
Victor	1705	6	Chestnut	R. Sommerfield, Tinana
Volunteer	1706	Aged	Chestnut	A. L. Gaden, Molangool
War Sash	1727	5	Dark bay	W. D. White and Sons, Bluff Downs
Weirwedge	1437	Aged	Bay	T. Flood, Goondiwindi
Winaspear	1384	5	Bay	C. Harsant, Harrisville
Wondul	1438	Aged	Bay	W. Sharp, Goondiwindi
Wyvern	1728	Aged	Dark chestnut	E. E. D. White, Bluff Downs
Xoanon	1467	5	Chestnut	J. Andrews, Dornford, Bowen

Pony Stallions Certificated for Life during Year 1936–37.

Alec	1488	6	Brown	J. Blakely, Sarina
Barney Google	1627	Aged	Brown	H. C. McKee, Duleen, Dalby
Bay Boy	1391	6	Bay	J. Kennedy, Pine Ridge, Southport
Bonnie Boy	1707	5	Bay	C. Jose, New Moonta
Bonny Blue	1729	5	Black	W. H. Bryant, Hewitt street, Charters Towers
Bonny Lad	1386	5	Cream	I. G. Bonney, Rosewood
Boonah Jewel	1392	5	Black	C. Sproxton, Maleny
Circus	1393	5	Piebald	J. Fenton, Beaudesert
Danny Boy	1439	5	Bay	J. Flynn, Clifton
Emir	1730	Aged	Black	Mount Elsie Estate Co., Mount Elsie
Harpace	1387	Aged	Bay	C. Arnold, Toogoolawah
La Cigale	1440	5	Bay or brown	R. C. Cooke, Upper Pilton, Clifton
Little Tom	1708	Aged	Grey	G. I. Titmarsh, Maryborough
Lord Loch	1412	5	Iron grey	J. Kenny, Lismore
Novelty	1628	5	Black	T. H. Saville, Ascot Mail, Greenmount
Nuggett	1709	5	Brown	H. Schmidt, Coringa, Degilbo
Prince	1441	Aged	Brown	J. A. Murray, Lagoon Flat, Texas
Red Robin	1442	6	Chestnut	E. F. Blomley, Eagle Bar, Bungunya
Shamrock	1389	6	Brown	C. A. Kanofski, Grandchester
Silver Dandy	1489	5	Taffy	W. J. S. Pitcher, Bell's Creek, Sarina
Silver King	1443	Aged	Grey	D. G. Cross, Boorandalla, Texas
Spotlight	1629	5	Brown	H. V. Farquharson, Ramsay, Cambooya
Stockings	1490	5	Chestnut	G. K. Gordon, Mount Pleasant, Binbee
Tom	1395	Aged	Dark bay	W. Morrison, House Mountain, Samford
Toy	1731	Aged	Chestnut	C. Meehan, Toonpan
Treasure	1396	5	Light chestnut	V. W. Francis, Cooran
Welsh Pride	1390	6	Piebald	J. Greenfield, Gatton
Wildfire	1491	6	Chestnut	G. K. Gordon, Mount Pleasant, Binbee

Trotter Stallions Certificated for Life during Year 1936–37.

Abbey Patch	1385	5	Cream	F. A. Hoger, Gatton
Childe Era	1486	Aged	Bay	C. Morgan, Chelona, Mackay
Grand Bells	1487	5	Chestnut	J. E. Kelly, Bowen
Machine Mantle	1426	6	Bay	R. G. Morrell, Elphinstone
Monto Wilkes	1499	5	Black	A. Thomasson, The Caves
Sparkling Ribbons	1419	5	Bay	P. D. Fiechtner, Greenmount
Vale Opera	1687	6	Dark chestnut	L. T. Graham, Goomeri

Draught Stallions Certificated for Life during Year 1936–37.

Allora Crystal	1445	5	Bay	W. Lysaght, Clinton Vale
Andrew Boy	1630	5	Brown	W. Biegel, Rywung
Athaldo	1476	Aged	Brown	C. J. Harding, Delta, Bowen
Baron	1732	Aged	Bay	W. H. F. Wordsworth, Manton, *via* Townsville
Baron Fancy	1631	5	Bay	S. Otto, Bum Bum Creek, Crow's Nest
Baron's Pride	1760	5	Bay	F. Mundey, Gladfield, Warwick
Baroona Badger	1733	Aged	Chestnut	Burke Bros., Brandon
Bay Boy	1756	5	Bay	L. Ryan, Baringha, G.N.R.
Bay Prince	1242	Aged	Bay	J. Cruice, Durundur, Woodford
Beau Ideal	1673	5	Bay	A. H. Greenup, Bancroft, Monto
Ben Bolt	1632	Aged	Bay	J. Ross, Captain's Mountain, Milmerran
Black Prince	1633	5	Black	J. Simmons, Coo-ee Ville, Milmerran
Blue Peter	1500	5	Blue roan	W. J. Lewis, Velindre Farm, Wowan
Bob of Abbotsleigh	1667	5	Bay	Estate W. C. Collins, Rosedale
Bold Lad	1674	Aged	Bay	A. T. Simpson, Aramara
Bold Laddie	1244	5	Bay	T. Armstrong, Rosewood
Bold Prince	1245	5	Bay	G. A. Heise, Minden
Bowler	1734	5	Bay	T. Kelly, Ayr
Bowler	1634	5	Bay	T. Gadsby, Wooleebee Junction
Brilliant Master	1675	5	Bay	R. Stark, M. P. Creek, Wondai

DRAUGHT STALLIONS CERTIFICATED FOR LIFE DURING YEAR 1936–37—*continued*.

Name.	No.	Age.	Description.	Owner.
British Prince	1246	5	Bay	M. O'Neill, Rockton, Peak Crossing
Briton	1447	6	Bay	R. Chandler, Forest Springs, Clifton
Brown Son	1735	Aged	Dark bay	Mrs. A. Haighton, Cuba Plains, Pentland
Browntyre	1468	Aged	Bay	M. M. Gordon, Grosvenor Downs, Nebo
Byron Minor	1413	Aged	Black	A. F. McLean, Paradise East, Elsmore, New South Wales
Captain	1676	5	Bay	H. Kopp, Degilbo
Captain	1469	5	Bay	A. Teitzel, Mount Dangar, Bowen
Captain	1736	Aged	Dark bay	J. Kelso, Townsville
Captain	1635	6	Bay	T. B. Freeman, Columboola
Captain	1737	Aged	Bay	Clark Bros., Mirtna, Charters Towers
Captain	1485	6	Bay	D. A. Roberts, Bundarra, Nebo
Carlyle	1636	5	Bay	M. J. Sommer, Goombungee
Carlyle Clinker	1448	5	Black	J. Gilmour, Springvale, Goomburra
Carlyle Perfection	1637	Aged	Bay	J. V. Willis, Meringandan
Chief	1638	5	Brown	J. A. Hick, Jackson
Chieftain	1738	Aged	Light bay	Hoey Bros., Brandon
Chinchilla Prince	1640	5	Black	H. L. Zerbst, Wamba Creek, Chinchilla
Chrystal	1639	5	Brown	N. R. Trousdell, Pinelands
Clyde Hill Intent	1406	5	Bay	J. Lehmann, Coolana, *via* Rosewood
Clydemere	1641	5	Bay	S. Hartwig, Groomsville, Pechey
Crown Duke	1643	5	Bay or brown	H. C. Dornbusch, Cross Hill, Oakey
Crystal's Pride	1449	5	Bay	A. F. Watt, Freestone
Cub	1677	6	Bay	G. A. Pollock, North Kolan
Danny	1644	5	Bay	L. Lloyd, Wandoan
Darkie	1470	Aged	Black	E. Hannon, Savannah
Darwin	1678	5	Bay	C. Cavanagh, junr., Kybong
Dobbin	1645	5	Bay	S. Marriage, Glenbrae, Narko
Don	1739	5	Brown	W. Porter, Home Hill
Don	1740	Aged	Bay	W. McLellan, Ayr
Donald Boy	1646	6	Bay	J. W. Wormwell Estate, Athlone, Meandarra
Don Bute	1668	5	Bay	H. C. Willert, Berajondo
Duke	1741	5	Bay	T. Cass, Balfe's Creek
Gay Lad	1397	5	Bay	G. White, Petrie
Glenlea Pride	1471	5	Bay	J. T. Dumma, Kuttabul
Haile Selassie	1669	5	Bay	W. A. Priddis, Wowan
Hermitage Lad	1450	5	Bay	H. A. Gillespie, Hermitage
Hero	1679	5	Chestnut	J. M. Taylor, Ness Farm, Childers
Highland Land	1647	5	Bay	E. H. Volker, Flagstone Creek, Helidon
Intent	1472	5	Bay	Land Bros., Eton Vale, Binbee
Irton Lustre	1247	5	Bay	West Moreton Horse Breeders' Association, Laidley
Jim Crow	1757	Aged	Brown	J. J. Webber, Ayr
Jolly Boy	1648	6	Dark bay	A. Hair, Lucksall, Dulacca
Jondaryan Janitor	1680	5	Bay	C. G. Walker, Tarong
Jondaryan Mac	1248	5	Bay	B. G. Kerle, Minden
Kadlunga	1742	Aged	Grey	W. D. White and Sons, Bluff Downs, Charters Towers
Landmark	1743	Aged	Chestnut	H. Bawden, Reid River, N.Q.
Larry	1649	Aged	Black	G. Stephens, Kiama, Hannaford
Lone Star	1451	5	Bay	Gross Bros., Campbell's Plains, Warwick
MacWallace	1744	Aged	Bay	G. Linton and Sons, Home Hill
Major	1651	Aged	Brown	Wellcamp Pastoral Co., Wellcamp
Major Dale	1249	5	Bay	C. A. Kanofski, Grandchester
Major Wallace II.	1398	5	Bay	F. A. Doeblein, Burnside, Yatala
Major Wylie	1653	5	Brown	H. Newton, Squaretop
Master Wheeler	1473	5	Brown	F. Bundesen, The Range, Eton
Model Farm Champion	1474	5	Bay	A. C. Williams, Homevale, Nebo
Model Meredin	1414	5	Brown	R. Stokes, Collingwood, Victoria
Montie	1745	5	Brown	C. B. MacPherson, Mingela
Moonlight	1746	Aged	Chestnut	W. C. Dennis, Selheim
New Hope	1650	5	Bay	E. Erhich, Greenmount
Noble	1681	5	Bay	T. O'Meara, Gleneden, Humphrey
Nobleman	1653	5	Dap. grey	J. R. H. Frizzell, Southbrook
Nugget Brown	1475	6	Brown	F. De Costa, Orkabie, N.C.L.
Oakwat Chancellor	1682	5	Brown	F. E. Mitchell, Silverleaf, Murgon
Power	1399	6	Bay	J. W. Gooding, Southport
Pride Again	1747	Aged	Bay	G. W. Davenport, Ayr
Pride of Dartmoor	1654	5	Bay	Mrs. E. H. Egan, Mount Tyson
Pride of Kinkabilla	1655	5	Bay	J. D. Dransfield, Kinkabilla, Meandarra
Pride Sheppard	1656	5	Bay	A. C. Kreig, Brookstead
Prince	1477	5	Chestnut	J. S. McFarlane, Eton
Prince	1670	5	Bay	H. A. McCartney, Yaamba
Prince	1452	5	Bay	J. W. Bickers, Kurrumbul
Prince	1250	5	Bay	R. E. Turpin, Lowood
Prince	1478	6	Bay	W. Watts, Wereena, Prosperine
Prince Campbell	1375	5	Bay	G. McKenzie, Dayboro'
Prince Foot	1671	5	Brown	J. C. Bayliss, Heathwood, Miriam Vale
Prince Henry	1400	5	Black	H. F. Storr, Beerburrum
Prince Henry	1657	5	Brown	F. D. Lipp, Greenmount
Prince Thomas	1658	5	Brown	A. Orr, Mount Irving, Aubigny
Prince Walston	1758	Aged	Bay	D. Meehan and Sons, Toonpan
Punch	1683	Aged	Roan	Hunter Bros., Mount View, Cinnabar
Punch	1659	Aged	Bay	A. J. Morris, West Haldon
Punch	1748	5	Bay	G. B. Klumpp, Home Hill
Rajah	1479	5	Chestnut	H. Ivers, Rosella, Mackay

DRAUGHT STALLIONS CERTIFICATED FOR LIFE DURING YEAR 1936-37—*continued.*

Name.	No.	Age.	Description.	Owner.
Renown II.	1401	5	Bay	J. T. Collett, Pomona
Ripplevale Treasure	1660	5	Bay	J. V. Willis, Meringandan
Roan Oak	1480	Aged	Roan	W. H. Gillham, Suttor Creek, Nebo
Robin	1661	Aged	Bay	W. S. Lumley, Milmerran
Royal	1481	Aged	Black	C. Zunker, Rosella, Mackay
Royal Dale	1402	5	Bay	C. Sproxton, Maleny
Royal Glencoe	1453	5	Brown	J. M. Thompson, junr., Stanthorpe
Royal Hope	1454	5	Bay	J. A. Murray, Lagoon Flats, Texas
Royal Master	1749	5	Bay	D. P. Jack, Brandon
Salamoniac	1455	5	Bay	Evan's Bros., Oona Vale, Goondiwindi
Scotchman	1403	Aged	Grey	M. J. Mangin, Goodna
Scotland	1750	6	Brown	J. Brabon, Harold street, West Townsville
Seargent	1662	5	Bay	E. A. Ward, Meandarra
Sherperd	1663	5	Bay	C. F. Nauschatz, Jandowae
Shepherd Hill Prince Charley	1684	5	Bay	R. B. Jeffries, Johnstown, Nanango
Sirdar	1751	Aged	Brown	Drysdale Bros., Pioneer
Star	1752	Aged	Brown	F. Cross, Mingela
Statesman	1753	Aged	Black	W. D. White and Sons, Toomba, N.Q.
St. Helen's Bruce Dale	1664	6	Bay	C. B. Bazley, Tipton, Dalby
St. Helen's Captain Windermere	1685	5	Bay	A. Sippel, Redgate, Murgon
The Rajah	1754	6	Brown	Mrs. E. C. Clarke, Maryvale, Charters Towers
Toby	1457	6	Bay	D. F. Marshall, Kondor, Goondiwindi
Toby	1482	Aged	Roan	H. A. Flohr, Wotonga, Nebo
Top Halls	1376	5	Bay	H. F. Dickfos, Gap View, Kalbar
Trimmer	1665	5	Bay	J. H. Morris, Hannaford
Trooper	1755	Aged	Black	R. C. Ramsay, Mingela
Wallace Monarch	1404	5	Bay	J. Murray, Bromelton, Beaudesert
Warrior	1759	5	Bay	W. Jackson, Myola, Balfe's Creek
Willie Mac	1405	5	Bay	W. A. K. McAulay, Yandina
Windermere Cellus	1686	5	Bay	L. C. Walker, Bingera
Worthy Prince	1666	5	Bay	Baumgarten and Sons, Meandarra
Wyaga	1456	5	Bay	Munro and Turner, Goondiwindi
Yacum	1484	5	Bay	J. Renwick, Proserpine
Young Dale	1672	5	Bay	J. B. Shannon, Tooloomba, Rockhampton
Young Hero	1377	5	Brown	G. C. Reinke, Minden

BLOOD STALLIONS CERTIFICATED FOR THE YEAR 1936-37.

Archer	1370	3	Brown	L. E. Gosson, Nanango
Beebo Shell	1152	3	Chestnut	D. W. Bell, Beebo
Bender Boy	1223	4	Bay	W. E. Stevens, 16 Mile Creek, Chinchilla
Bernor	1383	4	Bay	C. Meehan, Toonpan
Black Magic	1288	4	Brown	C. E. Froggatt, Nebo
Bon Aero	1138	3	Bay	P. Brennan, Jimboomba
Bronzoldo	1139	4	Chestnut	J. Daniels, Canungra
Brown Lock	1119	4	Bay	J. Reid, Glamorgan Vale
Brown Poitrel	1371	4	Brown	A. G. Cross, Kingaroy
Cannon King	1224	4	Chestnut	J. Thomas, Cooyar
Carawob	1225	4	Brown	D. Wormwell, Meandarra
Daily Leader	1153	4	Bay	S. C. Luck, Warwick
De-Wedge-Man	1155	3	Brown	R. Newman, Goondiwindi
Flywedge	1154	3	Brown	N. Wright, Goondiwindi
Gold Arrow	1226	4	Chestnut	S. S. Morris, West Haldon
Gold Dust	1227	4	Brown	W. J. Brazier, Jandowae
Golden Leaf	1384	4	Chestnut	C. W. A. Wordsworth, Manton
Havalock	1372	4	Brown	F. G. Willert, Goomeri
Hecla	1385	4	Brown or black	W. T. Wharton and Co., Lolworth
High Eagle	1228	4	Brown	R. C. K. Lethbridge, Mitchell
Idol Answer	1373	3	Brown	R. Webb, Beaconsfield
King Leo	1120	4	Bay	J. Stenzel, Carney's Creek
King's Colours	1289	4	Bay	G. M. Myers, Nebo
Lavender	1374	4	Chestnut	R. Sims, Aramara
Lord Leopolis	1229	3	Brown	Misses J. and N. Pomeroy, Toowoomba
Marlboro	1230	3	Chestnut	O. G. Ridge, Toowoomba
Master Cypher	1311	4	Bay	Miss G. E. Perrier, Mount Larcom
Mick Hatten	1137	3	Bay	H. Golz, Fassifern
Muscatel	1121	3	Bay	P. E. Logan, Upper Tent Hill
My Paddy	1231	3	Brown	H. A. Clark, Tara
Pandosto	1218	4	Brown	O. G. Ridge, Toowoomba
Pathfield	1310	4	Chestnut	F. Smith, Beaconsfield
Polyphonic	1375	3	Chestnut	M. MacDonnell, Gympie
Sea Laddie	1122	4	Black	T. J. Ford, Gatton
Senator	1319	4	Bay	R. G. Mackay, Morinish
Serf King	1290	4	Chestnut	A. T. Wellby, Mackay
Shumar	1232	4	Chestnut	H. V. Farquharson, Drayton
South Kerman	1123	4	Chestnut	J. H. Heck, Glamorgan Vale
Starlight	1376	3	Black	Mrs. L. J. Mackaway, Goomeri
Sunrise	1377	3	Chestnut	E. N. Sawtell, Coolabunia
Tantitha	1378	3	Bay	G. Briggs, Childers
Taubada	1233	4	Bay	Mrs. R. V. Breydon, Haden
Tibicen	1217	4	Bay	I. J. Moore, Ascot
Waratah	1379	4	Bay	G. W. Nahrung, Miva

BLOOD STALLIONS CERTIFICATED FOR THE YEAR 1936–37—*continued.*

Name.	No.	Age.	Description.	Owner.
Warrigal	1234	4	Chestnut	J. F. Lowien, Coalbank
Warwick Bachelor	1235	4	Brown	F. J. C. Martin, Kumbarilla
Warwick Lad	1124	3	Bay	G. A. Heise, Minden
Weir Wedge	1236	4	Brown	F. G. Searcy, Meandarra
Whiteflag	1125	3	Chestnut	R. Jackson, Munbilla
Zulu	1312	4	Black	F. A. Chardon, Mount Morgan
Unnamed (dead)	1208	3	Chestnut	A. A. Stokes, Abbotsford

PONY STALLIONS CERTIFICATED FOR THE YEAR 1936–37.

Name.	No.	Age.	Description.	Owner.
Ankor II.	1156	4	Dap. grey	W. Gilmore, Allora
Basra	1140	4	Bay	D. McDougall, Veresdale
Black Pride	1141	4	Brown	J. T. Collett, Pomona
Bonny Gem	1129	4	Bay	I. Ridge, Toowoomba
Boonah's Pride	1128	4	Black	G. E. Kirchner, Boonah
Cupid	1130	3	Bay	J. Duncan, Helidon
Darbie's Boy	1157	3	Grey	T. Hildred, Gladsfield
Darby	1380	4	Chestnut	Mrs. L. J. Mackaway, Goomeri
Essence of Fun	1131	3	Grey	I. Ridge, Toowoomba
Golden Laddie	1132	4	Chestnut	W. H. Strassburg, Lark Hill
Hope	1133	3	Bay	R. C. Draney, Laidley
Jacko	1158	3	Bay	N. T. Wright, Goondiwindi
Jimmy Boy	1237	4	Bay	P. T. Dwyer, Maclagan
Little Ken	1238	4	Black	J. C. Campbell, Haden
Little Sam	1381	4	Black	E. Althouse, Cloyna
Lord Ashwell	1159	3	Blue roan	C. Hensler, McLean street, Goondiwindi
Master Easmon	1386	4	Brown	W. Kelly, Ayr
Master Ludo	1216	3	Bay or brown	A. Kenyon, Eagle Farm
Migalo	1382	3	Bay	M. Daly, Gympie
Pilgrim	1134	3	Grey	D. D. Logan, Kilcoy
Pride of Allamby	1239	3	Bay or brown	H. P. Sperling, Crow's Nest
Ramadi	1135	4	Grey	I. Ridge, Toowoomba
Silver King II.	1136	4	Taffy	E. Grace, Maroon
Springmead Bright Fox	1209	3	Black	C. J. Cotter, Ipswich
Springmead Bright Lad	1221	4	Bay	Zeisemer Bros., Bongeen
Stibnite	1142	3	Iron grey	J. M. Newman, Caboolture

TROTTER STALLIONS CERTIFICATED FOR THE YEAR 1936–37.

Name.	No.	Age.	Description.	Owner.
Brisbane Chime	1151	4	Bay	B. Gooding, Southport
Chiming Derby	1220	3	Bay	S. H. Scells, Eveliegh street, Wooloowin
Cole Sound	1126	4	Bay	W. D. Dale, Rosewood
Derby Cole	1160	3	Bay	F. K. Weidman, Clifton
Direct Dean	1127	4	Bay	C. A. J. Tillack, Laidley

DRAUGHT STALLIONS CERTIFICATED FOR THE YEAR 1936–37.

Name.	No.	Age.	Description.	Owner.
Abbey Morn	1240	3	Brown	C. H. Frizzell, Southbrook
Adam	1082	4	Bay	J. McGrath, Moombra
Admiral Jack	1161	3	Bay	G. R. Shannon, Allora
Admiral Wallace	1162	3	Bay	P. J. Wilson, Elphinstone
Aerial Mail	1313	4	Bay	Camboon Pastoral Co., Camboon
Aldoman's Hope	1291	3	Bay	A. A. Brooks, Mackay
Arraglen	1322	4	Bay	Pownall and Pownall, Monto
Attraction	1323	4	Bay	R. T. Jones, Didcot
Bally	1241	3	Brown	G. Parton, Glenaven
Bally	1392	6	Bay	A. E. Carter, Home Hill
Barney	1324	3	Brown	T. Embrey, Kunioon
Baron Kerr	1083	3	Bay	J. Lehmann, Coolana
Baron Knight	1325	4	Bay	S. B. Scotney, Moorlands
Beau Laddie	1084	4	Bay	S. J. Draper, Woodford
Ben Attow	1388	3	Bay	W. D. White and Sons, Bluff Downs
Black Intent	1086	3	Black	D. Vogel, Boonah
Black Prince	1326	4	Brown	L. C. Walker, Bingera
Bold March	1327	3	Bay	L. Horne, Takura
Bold Noble	1328	5	Bay	W. T. Barrett, Bella Vale
Bonnie Intent	1329	4	Brown	W. Elsebach, Gayndah
Bonnie's Pride	1242	3	Bay	L. S. Gordon, Broxburn
Bonny	1314	3	Bay	R. W. Stirling, Theodore
Bonny Boy	1087	3	Bay	G. Erbacher, Harrisville
Bonny Shepperd	1287	3	Brown	W. Park, Toowoomba
British Abbot	1243	3	Brown	J. Sheedy, Yamsion
British King	1163	3	Bay	T. J. Ryan, Clinton Vale
British Prince	1330	4	Bay	C. F. Draheim, Murgon
British Royal	1212	3	Bay	Mrs. E. M. Craikie, Warwick
Burrendale George	1331	4	Bay	J. E. Stanton, Goomeri
Bute's Pride	1164	3	Chestnut	W. H. Hagenbach, Upper Freestone
Captain	1332	4	Bay	Mulcahy Bros., Nanango
Captain	1143	4	Bay	A. C. Andreassen, Tuchekoi
Captain Shepherd	1244	4	Brown	M. G. Polzin, Douglas
Captain Wallace	1088	4	Bay	W. E. Houston, Blackbutt

Draught Stallions Certificated for the Year 1936–37—*continued*.

Name.	No.	Age.	Description.	Owner.
Captain Wallace	1333	3	Bay	A. Perrett, Kingaroy
Carlisle Boy	1165	3	Bay	J. H. McIvor, Emu Vale
Carlyle Boy	1245	4	Bay	W. Redman, Braemar
Carlyle Chief	1206	3	Bay	J. H. Lawson, Camp Mountain
Carlyle Pet	1246	4	Bay	A. R. Curd and Sons, Jandowae
Carlyle's Hero	1369	3	Bay	R. Maudsley, Murgon
Cedric	1247	4	Black	E. C. Stark, Crow's Nest
Clematic Flash Mac	1089	4	Brown	J. M. Newman, Caboolture
Clinker	1166	4	Bay	V. Osborne, Cobba-da-mana
Clyde's Pride	1389	4	Bay	W. D. White and Sons, Toowoomba
Cornish Laddie	1090	3	Bay	J. Evans, Helidon
Craig Hero	1248	3	Bay	Derrick Bros., Bell
Crest Vale Nobility	1167	3	Roan	A. Ritson, Clifton
Crystal Boy	1199	6	Brown	S. Webster, Kilcoy
Crystal King	1334	4	Black	J. B. Edwards and Sons, Kingaroy
Crystal Macbride	1249	3	Bay	Mrs. H. Kewley, The Gums
Culverthorpe Favourite Hero	1261	4	Brown	T. W. Caldicott, Yandilla
Culverthorpe High Opinion	1335	3	Bay	S. B. Trigger, Lakeside
Dale	1293	4	Bay	W. H. Gillham, Nebo
Dale Square	1250	4	Brown	B. McGovern, Greenmount
Dalkerk	1336	3	Bay	R. G. Allen, Wolca
Damsel's Lad	1091	4	Bay	W. C. Miller, Stanmore
Dark Chief	1252	3	Brown	M. Stower, Linthorpe
Darnley Boy	1168	3	Bay	W. R. Penrose, Beebo
Dayfield	1292	3	Chestnut	A. T. Wellby, Glenella
Dick Turpin	1169	3	Bay	W. J. Jones, Emu Vale
Dobin	1294	3	Brown	G. M. Myers, Nebo
Dolphus	1337	3	Brown	E. Reinbott, Kingaroy
Donald	1390	3	Light bay	W. H. Jackson, Ayr
Don of Cracow	1338	3	Bay	A. E. Gorrie, Childers
Dooling Major Lea	1201	4	Bay	R. Stokes, Collingwood, Victoria
Dragon	1197	4	Bay	G. S. Burns, Goondiwindi
Duke	1339	3	Bay	F. E. Chippendale, Bollier
Duke of Gloucester	1196	4	Bay	J. Little, Cobba-da-mana
Empston	1092	3	Black	T. Zellinskie, Lake Clarendon
Eureka Waller	1321	3	Chestnut	Central Queensland Meat Export Co., Lakes Creek
Fairval Gaiety's Best	1170	4	Bay	W. J. McKee, Clifton
Fairval Noble	1295	3	Bay	S. R. Whitehead, Kuttabul
Fairval Regal Gaiety	1171	3	Bay	J. T. Scrymgeour, Warwick
Fairymead Baron Knight	1172	3	Bay	J. P. Warden, Goondiwindi
Fairymead Success	1340	3	Bay	Fairymead Sugar Co., Bundaberg
Farleton John	1391	4	Brown	A. P. Nelson, Charters Towers
Farmer's Pride	1093	3	Brown	R. Kucks, Wilson's Plains
Fashion's Prince	1173	3	Bay	T. J. Brosnan, Killarney
Favourite Blend	1203	3	Bay	A. A. Stokes, Abbotsford, Victoria
Gaiety Again	1174	3	Bay	W. P. Canning, Tannymorel
Gay Lad	1904	3	Bay	T. D. Gnech, Boonah
General Dale	1296	4	Brown	J. Martin, Mackay
General Douglas	1205	3	Bay	R. Stokes, Collingwood, Victoria
General Ker	1095	3	Bay	A. F. Schimke, Laidley
George Wallace	1176	4	Bay	T. J. Lyons, Clinton Vale
Gladfield	1341	4	Grey	Apel Bros., Gayndah
Glasgow Clyde	1252	3	Bay	A. Kahler, Geham
Glenbar Royalist	1254	3	Bay	J. V. Willis, Meringandan
Glen Donald	1255	4	Bay	Ada Perina and Sons, Crow's Nest
Glen Lock	1342	3	Bay	W. T. Birt, Theebine
Glenroy	1297	4	Black	A. Parkinson, Finch Hatton
Glen Royal	1343	3	Black	J. P. Fortune, Kingaroy
Glen the Second	1253	4	Bay	J. Tennyson, Chinchilla
Gold Mount Prince	1256	3	Brown	C. Mesken, Maclagan
Gold Naught	1177	3	Chestnut	D. Sullivan, Allora
Grove King	1298	4	Bay	B. J. Langford, Finch Hatton
Haile Selassie	1299	4	Brown	N. Mackay, Mirani
Hero	1178	6	Brown	A. E. Charles, Inglewood
Hero	1344	3	Bay	B. T. and L. Balderson, Theebine
Intention	1179	3	Brown or black	J. Dwyer, Clifton
Intent Laddie	1345	4	Bay	H. Siefert, Crawford
Intent's Perfection	1180	3	Bay	J. Glasheen, Clifton
Intent's Pride	1393	4	Bay	H. B. Burstall, Ayr
Irish Chief	1181	4	Bay	J. Madigan, Dalveen
Jack	1144	4	Bay	J. Hose, Pomona
Jackson	1257	3	Bay	W. D. Kirstenfeldt, Kulpi
Jelbyn Jock	1300	4	Bay	Wright and Davidson, Nelbo
Johnnie Walker	1258	3	Bay	T. Gadsby, Woolabee Junction
Jondaryan Duke	1259	4	Bay	G. W. Hartmann, Bowenville
Jondaryan Worthy Minstrel	1397	4	Bay	W. J. Lloyd, Harrow
Jondaryan Worthy Sheriff	1260	4	Bay	Eva B. Armstrong, Toowoomba
Jumbo	1301	4	Bay	S. Micallef, Eton
Kelso Surprise	1210	3	Bay	A. Stokes, Abbotsford, Victoria
Kerlock	1096	4	Black	R. E. A. Schafferius, Gatton
Kerr Lad	1097	4	Bay	H. D. Reisenleiter, Mount Sylvia

DRAUGHT STALLIONS CERTIFICATED FOR THE YEAR 1936-37—*continued.*

Name.	No.	Age.	Description.	Owner.
Kerr Son	1098	3	Black	N. D. Dallinger, Mount Sylvia
Kerrston Again	1099	4	Black	P. Ryan, Viewlands
Kerrston Again	1081	3	Black	G. Elliott, Laidley South
Kerrston Delight	1100	3	Chestnut	W. M. E. P. Prufert, Laidley
Kerrston Lad	1101	4	Black	S. H. Hallas, Gatton
Kerrston's Viceroy	1346	4	Black	W. D. Porter, Kumbia
Kerwein	1102	3	Bay	H. Schultz, Lake Clarendon
Kimbar Mailboy Jack	1262	4	Bay	O. G. Ridge, Toowoomba
Kingdale	1182	4	Bay	W. Eastwell, Warwick
King David	1103	3	Black	J. Burnham, Forest Hill
King Wyllie	1104	4	Black	F. T. Harm, Plainland
Knight	1105	4	Black	A. O. Raddatz, Ingoldsby
Knight Abbit	1396	Aged	Brown	W. R. Buckholz, Bundaberg
Lad	1315	4	Black	H. Nightingale, Goovigen
Lehmann's Tenor	1263	3	Brown	Mrs. R. V. Breydon, Haden
Lincoln	1302	4	Brown	F. O. Schmidt, Eton
Lion	1347	4	Bay	W. Ellicomb, Mundubbera
Logan Prince	1145	3	Bay	W. W. Bell, Rathdowney
Lord Kerrston	1264	3	Black	J. R. Anderson, Southbrook
Mac	1394	4	Bay	W. Conley, Ayr
Macadair	1348	3	Bay	J. Bishop, Maidenwell
Mail Boy's Heir	1146	3	Bay	R. H. F. Graham, Beaudesert
Major	1349	3	Brown	T. Turner, Kingaroy
Major Lace	1350	4	Black	H. Seiler, Stuart River
Major Robin	1213	3	Bay	J. Kelvington, Glenore Grove
Major Wallace	1222	4	Bay	E. J. Breen, Eukey
Major Wyllie	1219	4	Bay	J. Summerville, Kholo
Marshall Gaiety	1106	3	Bay	C. A. Martens, Marburg
Marshall Mark	1303	4	Bay	F. J. Muller, Bowen
Marshall Ney	1304	3	Roan	M. R. Shannon, Nebo
Master Carlyle	1266	4	Bay	G. H. Bidstrup, Warra
Master Dale	1107	3	Bay	H. O. Neumann, Plainlands
Master Wallace	1183	4	Bay	T. O'Dempsey, Lower Freestone
Master Wallace	1351	3	Bay	G. E. Spratt, Nanango
Max	1352	4	Bay	S. Anderson, Tingoora
Max Pride	1265	4	Black	L. McGrath, Oakey
Mountain Lad	1316	4	Bay	E. A. Russell, Thangool
Mull Mull Benson	1200	4	Bay	R. Stokes, Collingwood, Victoria
Mull Mill Prince Ronald	1207	3	Bay	R. Stokes, Collingwood, Victoria
Nigger	1267	3	Black	C. Dunemann, Murra Murra
Noble	1108	3	Bay	F. Lawrence, Gilla
Noble	1305	3	Bay	A. F. Claussen, Mackay
Noble Hero	1268	4	Brown	E. Ehrlich, Murra Murra
Noble Lad	1184	5	Roan	W. J. Ryan, Kincora
Noble's Choice	1353	3	Bay	J. W. Horrobin, Tingoora
Oakbranch	1354	3	Brown	A. A. Dent, Gayndah
Pensfield Lad	1306	4	Bay	G. H. Ellis, Merinda
Peter Jackson	1269	4	Bay	Baker Bros., Pty., Ltd., Bowenville
Pinevale Mainmast	1270	4	Black	Jondaryan Estates, Jondaryan
Plucky Prince	1317	4	Bay	W. H. Davey, Baralaba
Pop's Pride	1271	3	Bay	K. R. Jasch, Pampas
Pride	1272	3	Bay	S. E. O'Brien, Jandowae East
Prince	1274	4	Brown	M. J. MacGinley, West Haldon
Prince	1307	4	Chestnut	A. J. Diecke, Proserpine
Prince	1273	3	Bay	H. Simmons, Yandilla
Prince	1185	3	Bay	S. G. Bremner, Yelbarbon
Prince Abbey	1275	3	Black	G. and H. Tews, Pittsworth
Prince Dale	1355	4	Bay	F. Rekow, Bundaberg
Prince Dale	1147	4	Bay	W. Rudd, Mudgeeraba
Prince Fabric	1175	5	Brown	R. A. Roylance, The Pocket
Prince Henry	1276	4	Bay	Bebbington Bros., Cambooya
Prince Rocket	1356	3	Bay	McCauley and Stewart, Mundubbera
Prince Roy	1277	4	Bay	P. G. Ruhle, Motley
Punch	1318	4	Bay	A. Thomasson, The Caves
Rare Champion	1109	4	Bay	H. O. A. Bartholomai, Boonah
Revenue	1118	5	Bay	P. Connole, Helidon
Robin	1308	4	Bay	D. S. Miller, Don River
Robin of Lilyvale	1215	4	Bay	J. P. O'Hagan, Belmont
Rob Roy	1278	3	Black	A. H. Geirke, Chinchilla
Rodney	1395	4	Roan	C. Brownson, Charters Towers
Ron	1357	3	Bay	Cribb Bros., Gayndah
Rose Farm Bold Kerrston	1110	3	Bay	J. W. Evans, Boonah
Royal	1358	4	Brown	J. A. Perkins, Mundubbera
Royal Banker	1186	4	Black	Hart Bros., Pilton
Royal Chief	1559	3	Chestnut	W. R. Lester, Monduran
Royal Dale	1279	3	Black	I. N. Kahler, Geham
Royal Intent	1187	3	Bay	H. J. Pacholke, Clifton
Royal Kerr	1111	3	Bay	E. H. Weier, Hatton Vale
Royal Lamington	1360	4	Black	A. Birch, Murgon
Royal Mac	1361	3	Bay	J. McDermid, Monto
Royal Prince II.	1280	3	Bay or brown	G. V. Hess, Kaimkillenbun
Royal's Bride	1189	3	Bay	E. Collins, Warwick
Royal Scot	1281	3	Brown	J. L. Strack, Helidon
Royal Top	1188	4	Bay	A. N. McKechnie, Fleurbaix
Sandy Kerlin	1214	3	Brown	J. H. Kelvington, Glenore Grove

DRAUGHT STALLIONS CERTIFICATED FOR THE YEAR 1936–37—*continued.*

Name.	No.	Age.	Description.	Owner.
Shamrock	1190	4	Bay	M. Bourke, Yangan
Sir Earl	1112	3	Bay	S. V. Carseldine, Linville
Sir Nolan	1148	3	Bay	P. V. Campbell, Lamington
Sir Walter Samson	1362	5	Brown	R. J. McKenzie, Wallaville
Sonny Boy	1320	4	Bay	S. A. Barrett, Thangool
Sterling Slade	1202	4	Black	F. Powell, Richmond
Studleigh Laddie	1113	4	Bay	W. H. Grans, Upper Tent Hill
Sudden Surprise	1282	4	Brown	L. F. Kuhl, Narko
Sydler	1309	3	Bay	J. L. Dalton, Walkerston
Talgai Hero	1283	3	Black	W. Freyling, Hodgson Vale
Talgai John	1191	3	Bay	H. Sprott, Talgai West
Talgai Model	1192	4	Bay	J. J. Rynne, Goomburra
Tarzan	1114	3	Bay	Roderick Estate, Wilson's Plains
The Willow's Trustep	1193	4	Bay	A. M. Cadell, Texas
Toby	1364	5	Bay	T. Clark, Wietalaba
Toby	1149	3	Bay	J. Herron, Closeburn
Toby	1363	5	Roan	J. Malone, Sandy Creek
Trooper	1284	3	Bay	R. J. and L. V. Ole, Yarranlea
True Blue	1150	3	Grey	B. T. Smiles, Rathdowney
Ulupna Carl	1285	4	Bay	A. A. Treasure, Brigalow
Viron	1365	4	Bay	H. J. Rasmussen, Bundaberg
Wallace	1366	4	Bay	W. H. Lamke, Gundiah
Wallace Lad	1115	3	Bay	A. Muller, Mulgowie
Wickside Brilliant Son	1367	4	Bay	W. G. Currant, junr., Gunalda
Wildash Pride	1368	4	Black	W. J. Borchert, Murgon
Willowbank High Degree	1211	4	Black	J. Hamilton, Forest Hill
Worthy John	1194	4	Bay	W. A. Deacon, Allora
Worthy Lad	1116	3	Roan	P. Truloff, Minden
Yarradale Flash Marshall	1204	3	Brown	R. Stokes, Collingwood, Victoria
Young Douglas	1195	4	Bay	E. Costello, Thane
Young Kerrston	1117	3	Bay	B. O'Connor, Grantham
Young Ngapuna	1286	3	Bay	A. J. Harris, Yarranlea

REJECTED STALLIONS.

List of Stallions in respect of which Certificates of Registration were refused, on account of either lack of type and/or conformation, lack of size, or unsoundness during the year 1936-37. These horses are prohibited from service, either public or private:—

BLOOD STALLIONS REJECTED DURING 1936–37.

Name.	Age.	Description.	Reason for Rejection.	Owner.
David	Aged	Bay	L.T.	C. Mooney, Gin Gin
Julie Boy	3	Bay	L.T.	W. S. Forsyth, Gin Gin
Laddie Palms	4	Bay	Ost. and Curb	L. J. Russell, Thangool
Monarch	Aged	Brown	L.T. and Con.	J. G. Hollingsworth, Samford
Musician	Aged	Chestnut	L.T. and Con.	G. E. Archer, Charters Towers
Mutiara	5	Bay	Roarer	T. Addicott, Monto
Prince Henry	4	Bay	L.T. and Con.	G. Browne, Pittsworth
Rainbow	4	Piebald	L. Con.	W. Scantlebury, Theodore
Royal Bachelor	3	Bay	L.T. and Con.	J. A. Plant, Helidon
Sandy	5	Bay	Ringbone	T. B. Butterworth, Pindi Pindi
The Turk	3	Brown	L.T. and Con.	H. J. Watts, Yangan
Torpedo	6	Grey	L.T. and Con.	R. W. Brown, Kinkabilla
Westcott	3	Bay	L.T.	T. Toomey, Kingaroy
Young Mystic	Aged	Brown	Cataract	C. Myers, Nebo
..	5	Bay	L.T. and Con.	J. J. Johnston, Kerry
..	6	Bay	L.T. and Con.	J. T. Atkinson, Maryvale
..	5	Chestnut	L.T. and Con.	J. Waldron, Goondiwindi
..	4	Chestnut	L.T.	E. Diamond, Bundaberg
..	4	Chestnut	Spav. and Curb	E. Hopes, Rockhampton
..	6	Brown	L.T. and Con.	C. Quigley, Townsville

PONY STALLIONS REJECTED DURING 1936–37.

Name.	Age.	Description.	Reason for Rejection.	Owner.
Ace of Hearts	4	Brown	L. Con.	E. C. McNamee, Theodore
Black Feather	3	Brown	L.T.	G. Jones, Biggenden
Bright Laddie II.	4	Brown	Curb	V. C. Schelbach, Boonah
Darby Dean	Aged	Grey	L.T. and Con.	T. Walker, Maryvale
Don Pro	5	Bay	L.T.	J. Tinworth, Wondai
Teddie	Aged	Chestnut	L.T.	J. F. Leslie, Gympie
Welsh Boy	4	Bay	Ost.	G. Hart, Strathpine

TROTTER STALLION REJECTED DURING YEAR 1936–37.

..	Aged	Bay	Ringbone	—. Schafter, Mackay

DRAUGHT STALLIONS REJECTED DURING YEAR 1936–37.

Name.	Age.	Description.	Reason for Rejection.	Owner.
Baron Rich	3	Bay	L.T. and Con.	W. Kapernick, Murgon
Baron's Chief	Aged	Black	L.T. and Con.	Mrs. E. H. Egan, Mount Tyson
Black Prince	4	Black	Sidebone	W. J. Prasser, Kulpi
Blaze	5	Bay	Sidebone	Carroll Bros., Kingaroy
Blue Prince	5	Brown	Spavin	S. C. Zahmel, Finch Hatton
Blutcher	4	Brown	Sidebone	J. E. Holland, Wycarbah
Bold Boy	6	Bay	Sidebone	L. A. Armstrong, Rosewood
Bolder	3	Bay	L.T. and Con.	D. J. Soden, junr., Mount Beppo
Bold Jock	5	Grey	L.T. and Con.	A. J. Kuss, Ropeley
Boom's Best	3	Bay	L.T.	F. Tucker, Kingaroy
Bounce	3	Bay	L.T.	W. H. O. Smith, Ceratodus
Bright Star	3	Bay	L.T.	R. S. McKenzie, Mount Perry
British King	4	Bay	L.T.	R. Kahler, Deep Creek
Bunny	4	Grey	Sidebone	R. M. Inslay, Bouldercombe
Captain	Aged	Chestnut	Size	G. L. Kelton, Dulacca
Charlie	4	Bay	L.T. and Con.	H. P. Opperman, Tamborine
Clan McDhu	5	Bay	L.T.	A. E. Gorrie, Childers
Clyde	5	Black	Sidebone	J. O'Leary, Leyburn
Crystal Son	Aged	Bay	Sidebone	A. S. Burdell, Bohle River
Diamond	Aged	Brown	L.T. and Con.	J. Guy, Ayr
Dodger	5	Brown	L.T. and Con.	C. V. Roberts, The Wallan
Don	Aged	Brown	Sidebone	B. Weekes, Bowen
Don	6	Bay	L.T. and Con.	W. J. Langton, Gilla
Donald's Pride	4	Black	L.T. and Con.	C. J. Hegarty, Clifton
Earl Marshall	5	Bay	Spavin	G. W. Orchard, Parapi
Evergreen Lad	3	Bay	L.T. and Con.	E. A. Munt, Maclagan
Exile	Aged	Black	Sidebone	W. Brazier, Jinghi Jinghi
Grand Master	5	Bay	L.T.	J. W. Betts, Kolan River South
Happy Charlie	3	Grey	L.T. and Con.	A. J. Rose, Chinchilla
Highfield Challenging	5	Bay	Bog Spavin	R. H. Applin, Biloela
Kenstar	5	Brown	Sidebone	J. Bridgeman, Cracow
Laddie	4	Bay	Sidebone	L. A. Ruhle, Motley
Lawrie	5	Bay	L.T.	R. Sommerfield, Tinana
Lorna's Pride	Aged	Bay	Sidebone	H. Bell, Toogoolawah
Major	6	Chestnut	Sidebone	H. Northdurft, Oakey
Major II.	3	Bay	L.T.	O. Horton, Kingaroy
Monte Carlo	4	Bay	Sidebone	T. C. Hoffman, Gladfield
Noble	5	Brown	Sidebone	W. E. Stark, Kingaroy
Noble	3	Bay	L.T.	G. Duffy, Neumgna
Noble	4	Bay	L.T.	Cowan Keys, Wondai
Olad	4	Bay	Thoropin	C. G. King, Goombungee
Pancho	3	Roan	L.T. and Con.	A. Erlandsen, Milmerran
Prince	5	Bay	L.T.	G. A. Elliott, junr., Dallarnil
Prince	4	Bay	L.T. and Con.	G. J. Austin, Crow's Nest
Prince Isles	5	Bay	L.T.	G. A. Steinhardt, Murgon
Prince Valley	5	Chestnut	Sidebone	Aplin Bros., Maroondan
Punch	5	Bay	L.T. and Con.	H. F. Scholoss, Dayboro'
Punch	3	Bay	L.T. and Con.	H. Webb, Reid River
Ravendale	6	Black	L.T. and Con.	W. Burgess, Laidley
Royal Wallace	4	Bay	Sidebone	N. G. Walker, Iveragh
Scottish Airs	4	Bay	Sidebone	V. C. Cutmore, Burndale
Shepherd's Robin	5	Bay	Sidebone	M. R. Shannon, Nebo
Sir Charles	5	Bay	Sidebone	V. C. Potter, Speedwell
Snip	5	Bay	Side and Spav	R. Stanbury, Proserpine
Special Mac	6	Bay	Sidebone	D. G. McIntosh, Goomeri
Standard	Aged	Skewbald	Sidebone	F. Kelly, Ayr
Stepford Belted Knight	6	Bay	Roarer	J. M. Hagenbach, Upper Freestone
Tarzen	3	Bay	L.T.	C. J. Zilkie, Bundaberg
The Sheriff	3	Brown	L.T. and Con.	A. Mutze, Umbiram
Toby	4	Bay	L.T. and Con.	H. McClymont, Oman-ama
Tom	6	Bay	L.T. and Con.	N. M. Watson, Ripley
Vanguard	4	Brown	L.T.	R. Briggs, Mount Perry
Willengie	Aged	Bay	L. Con.	W. J. Stanley, Cannon Valley
Worthy Carlisle	6	Bay	Sidebone	P. Truloff, Minden
Young Ivanhoe	5	Black	Sidebone	T. H. Oberhardt, Pittsworth
..	6	Bay	L.T. and Con.	W. G. Soper, Home Hill
..	3	Bay	L.T.	H. D. Giles, Biggenden
..	Aged	Brown	L. Con.	J. E. White, Rockhampton
..	Aged	Grey	L. Con.	S. Sammut, Alligator Creek
..	4	Bay	Sidebone	L. Jockheim, Longford Creek
..	3	Bay	Ringbone	J. Head, Mirani

AGRICULTURE ON THE AIR.

RADIO LECTURES ON RURAL SUBJECTS.

Arrangements have been completed with the Australian Broadcasting Commission for the regular delivery of further radio lectures from Station 4QG, Brisbane, by Officers of the Department of Agriculture and Stock.

On Friday of each week, as from the 6th January, 1937, a fifteen minutes' talk, commencing at 12.45 p.m., will be given on subjects of especial interest to farmers.

Following is the list of lectures until the 30th April, 1937.

SCHEDULE OF LECTURES.

BY OFFICERS OF THE DEPARTMENT OF AGRICULTURE AND STOCK, RADIO STATION 4QG, BRISBANE (AUSTRALIAN BROADCASTING COMMISSION).

Friday, 8th January, 1937—''Humus and the Soil,'' by E. H. Gurney, Agricultural Chemist.

Friday, 15th January, 1937—''Citrus Orchard Practices,'' by R. L. Prest, Instructor in Fruit Culture.

Friday, 22nd January, 1937—''Looking Ahead—New Developments in Agriculture,'' by J. F. F. Reid, Editor of Publications.

Friday, 29th January, 1937—''Some Introduced Grasses—(1) Summer-growing varieties; (2) Winter varieties,'' by C. T. White, Government Botanist.

Friday, 5th February, 1937—''The Importance of Type in Queensland Merino Flocks,'' by J. L. Hodge, Instructor in Sheep and Wool.

Friday, 12th February, 1937—''Fat Lambs in Queensland,'' by J. L. Hodge, Instructor in Sheep and Wool.

Friday, 19th February, 1937—''Increase your Return from Eggs. How it can be done,'' by P. Rumball, Poultry Expert.

Friday, 26th February, 1937—''With the Flock in February. Points for the Poultry Farmer,'' by J. J. McLachlan, Poultry Inspector.

Friday, 5th March, 1937—''The Harvesting of Cotton,'' by R. W. Peters, Cotton Experimentalist.

Friday, 12th March, 1937—''Plant Nutrition,'' by E. H. Gurney, Agricultural Chemist.

Friday, 19th March, 1937—''Sheep Management under the Varying Conditions in Queensland,'' by Jas. Carew, Senior Instructor in Sheep and Wool.

Friday, 26th March, 1937—''The Care of the Flock,'' by Jas. Carew, Senior Instructor in Sheep and Wool.

Friday, 2nd April, 1937—''Winter Pastures,'' by C. W. Winders, Assistant (Agronomy).

Friday, 9th April, 1937—''Pork Products as Regular Items on the Menu,'' by E. J. Shelton, Senior Instructor in Pig Raising.

Friday, 16th April, 1937—''Some Poultry Farmers' Problems. What to Breed and How to Breed,'' by J. J. McLachlan, Poultry Inspector.

Friday, 23rd April, 1937—''Strawberry Planting and Other Seasonal Fruit Hints,'' by H. Barnes, Director of Fruit Culture.

Friday, 30th April, 1937—''Wheat Improvement in Queensland,'' by R. E. Soutter, Agricultural Research Officer.

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NOTICE TO SUBSCRIBERS.

When renewing your subscription, write your full name plainly, preferably in block letters.

Address your renewal to the Under Secretary, Department of Agriculture and Stock, Brisbane.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society and Jersey Cattle Society, production charts for which were compiled during the month of November, 1936 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORNS.				
MATURE COW (OVER 5 YEARS), STANDARD 350 LB.				
Dot 5th of Oakvilla (238 days)	W. G. Marquardt, Springlands, Wondai	11,274·1	443·873	Victory of Greyleigh
Starlight II. of Oakvilla (227 days)	W. G. Marquardt, Springlands, Wondai	10,352·25	414·096	Victory of Greyleigh
Daisy 5th of Oakvilla (236 days)	W. G. Marquardt, Springlands, Wondai	9,704·65	381·447	Gussie
JUNIOR 3 (UNDER 3½ YEARS), STANDARD 270 LB.				
College Dinah	Queensland Agricultural High School and College	6,828·46	296·63	Duplex of Greyleigh
JERSEY.				
JUNIOR 4 (UNDER 4½ YEARS), STANDARD 310 LB.				
Trecarne Merle 4th	D. R. Hutton, Cunningham	7,001·46	395·579	Trecarne Golden King
SENIOR 2 (OVER 2½ YEARS), STANDARD 250 LB.				
Wyreene Chance	J. B. Keys, Gowrie Little Plain	5,898·25	313·609	Lyndhurst Majesty

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.

Specimens from the Lockyer Identified.

J.C., Project Club (Calvert)—

1. *Angophera intermedia* (apple tree). The apple tree is used as fodder in times of drought, but it is generally conceded that it is of little nutritive value.
2. *Crotalaria linifolia,* a small species of rattlepod.
3. *Gnaphalium japonicum* (cud weed).
4. *Eryngium rostratum* (Queensland eryngo).
5. *Boerhaavia diffusa* (tar vine). This plant is very widely distributed throughout Queensland both on the coast and inland. In the more inland parts of the State it is generally regarded as excellent fodder for stock.
6. *Alternanthera nana.* Species of Alternanthera are common weeds in the mixed native pasture and in cultivations in Queensland. They belong to the Amaranth family, and are quite wholesome.
7. *Sida* sp., probably *S. spicata,* a native weed allied to to *Sida retusa.*
8. This specimen is rather poor, but we should say it represents *Atriplex semibaccata,* the creeping salt bush or salt weed. It is generally regarded as quite good fodder.
9. *Modiola multifida* (button mallow).
10. *Eustrephus latifolius* var. *angustifolius,* a climbing plant of the lily family. The only name we have heard applied to it is native orange, due to the small orange red fruits which it bears.
11. *Neptunia gracilis* (the sensitive plant).
12. *Myoporum debile.*
13. There is a mixture here. The yellow flower belongs to a species of Goodenia, and the small, leafy stalk to a species of Phyllanthus. The specimens are too fragmentary for specific determination.
14. *Polygonum aviculare* (knot grass or knot weed). A very common weed in cultivations in Southern Queensland, particularly on the Darling Downs. It is not known to possess any harmful properties, although the long, running stems sometimes cause impaction.
15. *Celtis sinensis* (Chinese celtis). This is also commonly called the Portuguese elm, but it is not a native of Portugal, and this name belongs more particularly to *Celtisaustralis.* It is not very common, being seen occasionally in gardens and at a few places on the Darling Downs. The leaves are excellent fodder for stock.
16. *Swainsona* sp., a variety of Darling pea.
17. *Phaseolus lathyroides.* This is a leguminous plant, a native of tropical America, introduced into Queensland some years ago as a fodder. So far as our experience goes, however, stock do not take to it very readily. It is now a fairly common naturalised weed in many localities.
18. *Helichrysum ramosissimum,* a small native everlasting.

Cestrum Parqui. Poison Peach.

C.N.H. (Didcot)—

The specimen represents *Cestrum parqui* (the green cestrum), a native of Chili and the Argentine, now a naturalised weed in Queensland. It is poisonous to stock, and severe losses in South Queensland have been traced to it during recent years.

Poison peach is a different shrub (*Trema aspera*). In spite of its name this plant is often very freely eaten by stock without any ill effects following. At times, however, it develops a prussic acid-yielding glucoside, and if eaten heavily by hungry stock may cause death.

Beaudesert Plants Identified.

L.T. (Jimboomba)—

1. *Dodonæa viscosa* (hop bush). This is a small tree very common in Queensland both on the coast and inland. The leaves are used for fodder in times of drought, but it is not a particularly good fodder plant.
2. *Oxalis corniculata* (wood sorrel), a very common weed with an acid taste. It is sometimes mistaken for a legume.
3. *Lepidium ruderale* (bitter cress). This is one of the numerous weeds known in Queensland as mustard or turnip weed. It is quite a good fodder, but taints milk rather badly.
4. *Callistemon viminalis* (red bottle brush).
5. *Epaltes australis.*
6. *Hypericum gramineum* (St. John's wort).
7. *Phyllanthus thesioides.* This small plant is sometimes seen in the native mixed pasture. It is usually not very abundant in any one locality, and we have heard no local name given to it. So far as we know it possesses no particular properties of any interest, either useful or otherwise.
8. *Helichrysum ramosissimum,* a small native everlasting.
9. *Gnaphalium japonicum* (cud weed). Species of cud weed are very common in Queensland, both in pasture land and old cultivation paddocks. It is not known to possess any poisonous or harmful properties.
10. *Poranthera microphylla,* sometimes known as small poranthera.
11. *Jasminum suavissimum,* a native jasminth.
12. *Plantago lanceolata* (rib grass). This is not a true grass, but a member of the family Plantaginaceæ. In some countries it is regarded as quite good fodder, but in Queensland stock do not seem to take readily to it.
13. *Mallotus philippinensis* (Kamala tree). This is a very common tree in Queensland, and extends to India. The red, powdery substance surrounding the seeds is said to be used as a vermifuge.
14. *Galinsoga parviflora* (yellow weed). This is a common weed in cultivations in Queensland. It is generally regarded as quite good fodder for stock, particularly poultry.

Milky Cotton Bush. Tie Bush.

F.C. (Ormeau)—

1. *Asclepias curassavica* (red head or milky cotton bush), a native of tropical America, but now naturalised as a weed in most tropical and sub-tropical countries. It is quite common in Queensland, particularly along creeks and in gullies. It is poisonous to stock, but, generally, is not eaten by them in sufficient quantity to cause trouble.
2. *Wickstrœmia indica,* commonly called tie bush on account of the fibrous nature of the bark. It is a native shrub very common in some localities and reputed to be poisonous to stock. Some years ago feeding experiments with this plant were carried out with leafy material at the Animal Health Station, Yeerongpilly, and after about a fortnight the heifers showed signs of emaciation and bloody scours, but recovered when put on ordinary food. A couple of years ago we received specimens of the berry of this plant from the vomit of a child which had died through eating a number of fruits of this plant. They are small, red, and succulent. A quntity were gathered and fed to guinea pigs at Yeerongpilly. The guinea pigs died in convulsions very shortly after feeding.

In the circumstances, the eradication of both these plants is recommended.

Daisy Bush.

J.E.L. (Monto)—

The specimens represent a species of daisy bush (*Olearia elliptica*), very common in some parts of Queensland, particularly as undergrowth or on the edge of some of our drier scrubs in the Burnett and Darling Downs districts. The plant is not known to possess any poisonous or harmful properties, but, as you suspect it, it might be as well for you to forward some samples as fresh as possible for the Agricultural Chemist to test for the formation of a prussic acid-yielding glucoside. The sample supplied is too dried and rather meagre for the purpose. About ½ lb. sent in as fresh as possible would be desirable.

Sudan Grass.

G.W.D. (Dalrymple Heights, Mackay)—

The Agricultural Chemist, Mr. Gurney, advises that Sudan grass does at times contain a prussic acid-yielding glucoside, but nothing to the same extent as the other sorghums, and usually it is quite free. In the circumstances, however, it is wise to use a little caution and not feed the grass in its young stage, nor allow empty cows to gorge themselves on it. It is also advisable to cut the grass and allow it to wilt before feeding. Sudan grass is essentially a summer fodder.

Blue Bush.

Inquirer (Yeerongpilly)—

Your specimen represents *Chenopodium auricomum*, blue bush. It is a native Chenopodium, sometimes called fat hen, although blue bush is the more common name applied to it. It is generally regarded as quite good fodder in the absence of better feed.

Johnson Grass. Knot Grass.

E.M. (Rathdowney)—

1. *Sorghum halepense,* Johnson grass. This grass is rather a pest in cultivation, as it spreads very rapidly. If any of its roots are cut up each little piece possessing an eye is capable of forming a new plant. The grass is often used for fodder, and stock seem to be rather fond of it, but, as with other members of the sorghum family, a certain amount of care should be exercised in feeding. Like other sorghums it contains a prussic acid-yielding glucoside.

2. *Polygonum aviculare,* knot grass or knot weed, a fairly common farm weed in South-Eastern Queensland, particularly on the Darling Downs and in the Lockyer and Fassifern districts. It is not known to be poisonous, but the long, stringy, fibrous stems may cause impaction if stock eat them to any extent.

CROWN LAND FOR GRAZING HOMESTEAD SELECTION.

ST. GEORGE DISTRICT.

38,625 acres of Sheep Land. Part of Mona expired Holding.

This land, being surveyed portion 4, parish of Dewurra, will be open for Grazing Homestead Selection at the Land Office, St. George, on Tuesday, 2nd February, 1937, for a term of lease of twenty-eight years and at an annual rental of ⅜d. per acre during the first period of seven years.

The improvements on the land are provisionally valued at £388 and comprise fencing.

Special conditions will require the enclosing of the land with a fence which is both rabbit-proof and marsupial-proof during the first three years; the destruction of all prickly-pear during the first year and the ringbarking of 7,000 acres during the first seven years.

The land is watered both naturally and by bore drains, but further water will probably be required. The portion contains patches of belar, wilga, gidya, and mulga scrubs.

Free lithographs and full particulars may be obtained from the Lands Department, Brisbane, the Land Agent, St. George, and the Government Intelligence Bureaux, Sydney and Melbourne.

General Notes

Staff Changes and Appointments.

Messrs. E. H. Gurney, Agricultural Chemist, and W. T. Gettons, Accountant, of the Department of Agriculture and Stock, have been appointed to act temporarily as members of the Central Sugar Cane Prices Board at any time that Messrs. J. M. MacGibbon and A. R. Henry, respectively, may be prevented, through any cause, from attending a meeting of such Board.

Messrs. H. G. Gillan, Colonial Sugar Refining Co., Ltd., Victoria Mill, via Ingham, and J. J. Taylor, Emily street, Highgate Hill, have been appointed honorary rangers under the Animals and Birds Acts, and Mr. T. W. Hardcastle, Boonah, has been appointed an honorary ranger under the Animals and Birds Acts and the Native Plants Protection Act.

Mr. J. A. Hennessy, Somerset Dam, via Esk, has been appointed an honorary ranger under the Animals and Birds Acts.

The appointment of Mr. W. H. Kirk, Auburn, via Chinchilla, as an honorary acting inspector of stock, has been cancelled.

Mr. N. Stubbings (Mundubbera) has been appointed an honorary ranger under the Animals and Birds Acts, and Messrs. W. Schneid (Mudgeeraba), A. Ludke (Nerang), H. Lee (Numinbah Road, via Nerang), and A. L. Sprenger (Mudgeeraba), patrolmen, Nerang Shire Council, have been appointed honorary rangers under the Native Plants Protection Act.

Mr. C. J. F. Swinburne, Durikai, has been appointed Instructor in Sheep and Wool, Department of Agriculture and Stock.

Messrs. G. H. Williams (Kureen), W. J. Sloan (Malanda), J. F. Britton (Malanda), R. T. Croker (Malanda), and W. C. Gordon (Kureen), have been appointed honorary rangers under the Animals and Birds Acts.

Messrs. A. J. Busuttin (Brampton Island, via Mackay), F. C. Wooster (Newry Island, via Kuttabul), and R. B. Jamieson (Proserpine), have been appointed honorary rangers under the Animals and Birds Acts and the Native Plants Protection Act.

"Filler" in Fertilizer.

A Regulation has been issued under "The Fertilizers Act of 1935" providing that the maximum weight and common name of any "filler" contained in any mechanically mixed fertilizer shall be declared on the label attached thereto.

Stanthorpe Fruit and Vegetables Levy.

Executive Council approval has been given, under the Fruit Marketing Organisation Acts, to an extension of the Stanthorpe fruit and vegetables general levy for a further period of twelve months, as from the 22nd December, 1936. This levy is payable by fruit and vegetable growers in the Granite Belt who consign their produce by rail or road in any one lot with a minimum of half a hundredweight and upwards. The amount of such levy is 3s. 4d. per ton, and a proportionate part of this amount is provided for each portion of a ton of fruit and/or vegetables.

Wild Life Preservation.

The recently declared National Park Reserve extending from Pioneer Point to Cape Conway, between Mackay and Proserpine, has been declared a sanctuary under the Animals and Birds Acts, and it will accordingly be an offence to take or kill any native animal or bird within the boundaries of this sanctuary.

Committee of Direction of Fruit Marketing.

Under the Regulations in force under the Fruit Marketing Organisation Acts, the various sectional group committees, with the exception of the "Other Fruits" sectional group committee, appoint two representatives to the Committee of Direction of Fruit Marketing.

An amendment of the Regulations has been approved, which will provide that the "other fruits" sectional group committee shall also have two representatives on the Committee of Direction, instead of one as formerly.

Commodity Board Ballots.

Certain regulations under the Primary Producers' Organisation and Marketing Acts, dealing with the conduct of ballots in connection with commodity boards have been rescinded, and fresh regulations issued in lieu thereof. The regulations, in their amended form, merely allow of certain slight alterations in the existing procedure, and provide that nominations in connection with pool board elections may be lodged with either the Returning Officer, or some person specified by the Minister. Again, ballot papers may be placed in a ballot box provided by the Returning Officer as well as forwarded through the post, as formerly.

Papaw Levy.

Approval has been given, under the Fruit Marketing Organisation Acts, to the extension, for a further twelve months, of the Papaw Levy Regulation. The extension will operate as from 2nd January.

Animals and Birds Sanctuary near Goomeri.

Tansey Reserve, Goomeri, has been declared a sanctuary for the protection of native birds and animals under *"The Animals and Birds Acts,* 1921 *to* 1924."

Central Sugar Cane Prices Board Election.

Following is the result of the election for Canegrowers' and Millowners' Representatives on the Central Sugar Cane Prices Board held on the 13th November, 1936:—

Canegrowers' Representative—	
Powell, T. A.	2,573
Holt, F. J. E.	977
Hudson, G. F.	923
Kirwan, P.	102
Informal	79
Millowners' Representative—	
Smith, E. S.	Returned unopposed

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BOBBY CALVES.

In the last few years a trade has developed in veal, both for local consumption and for export. This trade has been of immense value to the dairy farmer, for in the past it has been the practice on many farms, where the carrying capacity is limited, to destroy all calves at birth. With the opening of this trade in bobby calves, the farmer has been able to obtain a return for what were previously useless calves.

Unfortunately, with some farmers, the practice is to send calves to the meatworks as soon as they are born, in what is really an immature condition. At one slaughtering establishment the total number of calves slaughtered in one year was 4,823, and of this number 538 were condemned as unfit for consumption, giving a condemnation of 11.11 per cent. This figure, obtained from a works situated in a farming district, is probably low for calves which must be trucked to works. The principal cause of these condemnations was immaturity. This loss could easily have been avoided by retaining the calf for ten days longer on the farm.

The milk of a newly-calved cow is fed to pigs and poultry, and is therefore not wasted, but it should be borne in mind that this milk would show a better return if fed to the new-born calf than if fed to pigs. The value of this milk is often not so much as a weight increaser as a preventer of weight loss. This is true of the larger breeds. With the smaller breeds its value is, of course, primarily for growth.

The law provides for a dressed weight of not less than 40 lb., and not less than fourteen days old.

Not only are condemned calves a direct loss to the farmer, but they involve the meatworks in loss, due to wasted labour in dressing, &c.

Mature veal is a wholesome food article, while immature veal, which has a laxative effect on the consumer, is not allowed on the market for consumption.

This loss, due to immature calves, can be avoided if the calf is fed for a few days on the milk of the freshly-calved cow. The calf should weigh 80 lb. or more live weight, before being sent to the meatworks. This live weight will give a dressed carcase of approximately 40 lb.

Rural Topics

Grading of Onions is Essential.

The quality of onions grown in Queensland is recognised by purchasers in the Southern States, the varieties of onions produced being of good flavour, stout and firm in texture, and capable of withstanding the stress of transport without serious bruising or other damage.

Buyers, however, have raised complaints because of onions being forwarded to market without due regard being given to the classification of the onions in accordance with the size of the bulbs. It is the custom of some growers to include large and small sized onions in the same bag. This practice is against the interests of the farmer, and is contrary to the wishes of the selling agents, and results in comparatively lower realisations on the market.

Farmers who have included onion growing in their cropping programme for the coming year are reminded that onions should be classified in acordance with their size. The small sized onions, say, below 2 inches in diameter, should represent one ''size'' grade. Onions ranging from 2 inches to less than 3 inches in diameter should comprise another grade, and onions from 3 inches to 4 inches in diameter should form a further grade.

Some growers prefer to classify the onions in grades in agreement with each ½-inch increase in diameter. This practice results in the onions in each grade being particularly even and uniform in appearance.

The number of grade classifications should be determined by the variation that occurs in the size of the individual bulbs comprising the crop. In ordinary circumstances, the classification of the bulbs into three or four grades will suffice. It is important, however, that the onions should be graded as evenly as practicable, and to effect the elimination of all ''outsized'' bulbs, especially the onions that are coarse, and are customarily referred to as ''bull-necks.''

The market prospects for 1937 are good, and no doubt the ultimate realisations will be governed very largely by the care that is taken by growers in placing the bulbs on the market in a manner conforming with the requirements of the trade.

As the defect complained if is purely of a mechanical nature, the remedy is comparatively simple, and capable of correction by any growers desiring to take suitable action.

Careless Branding of Stock.

Some stockowners exhibit great carelessness in branding their stock, cattle particularly. A visit to any of the large saleyards will reveal the slovenly use of branding irons. Not only are slipshop methods employed, but in some cases there is evidence of actual, but unintentional, cruelty. It is cruel to hold the hot iron on an animal until the skin is burnt through, and it is quite unnecessary. This practice may be due to underheated irons, but it may be due to over-hot irons held on the skin a fraction of a second too long, or with too much pressure. Such branding causes blotches, and very often the actual letters or figures are undecipherable. The skin in the area involved is urined for tanning purposes, and festering sores may result. Identification of the animal by means of such a brand is rendered very difficult, if not impossible.

It is a well-known fact that, on large stations, where thousands of calves are branded yearly, and where speed is a factor in the handling of large mobs, the standard of branding is much higher than on some small holdings, such as farms, where only two or three calves may be branded at irregular periods.

Good Grazing Depends on Control of Pastures.

Dairy farmers and stock raisers are advised to make a critical examination of their permanent pastures with an eye to the future of the most useful paddocks. In many instances the land-holder will find his pastures of paspalum, Rhodes grass, &c., to consist of a series of closely grazed patches interspersed with clumps comprised for the most part of dried stemmy grass which the stock will not touch. It is easy to visualise what will be the condition of these pastures during the coming spring. If the usual grazing methods are not improved upon the clumps which are useless now will remain neglected by stock, and will produce rank growth of no value for grazing. This means, of course, a very serious reduction in the total area of pasture actually grazed. The explanation of such uneven grazing lies in the preference shown by stock for short, leafy grass, which has a much higher feeding value than the same grass in a rank and stemmy condition, for when an animal is turned into a paddock which supplies a superabundance of feed it will graze the pasture in patches and will return again and again to these short patches, neglecting the overgrown clumps.

The first step in any plan designed with the object of keeping the whole of the grazing area in the short, leafy condition is to ensure adequate control of the pastures. This can be effected only by subdivision of large paddocks. While holdings of 160 acres continue to contain paddocks of 20 acres or more, so long will pasture be wasted as a direct consequence of insufficient control of the grazing areas. The extent of subdivision desirable depends upon the size of the herd or flock, upon the shape of the farm, upon the topography, upon the class of pasture, and so on. Consequently, no hard and fast rule can be laid down. The aim is to have each paddock small enough to permit of the producing stock grazing the pasture down evenly within a few days. Ten or twelve dairy cows concentrated on 1 acre of paspalum pasture about 6 inches tall will within a week have the pasture well down, so a farmer milking on an average sixty cows might have his better grazing area divided into a number of paddocks each 5 or 6 acres in extent. The number of paddocks should be six or more, as this will allow each paddock to be grazed for a few days when the grass is 5 or 6 inches high. Under favourable seasonal conditions, using six paddocks, the first grazed paddock should be ready for grazing again after the other five have been grazed in rotation. In most districts, however, there is great risk of sudden rainfall deficiency, and under these conditions nine or ten paddocks should be provided for rotational grazing purposes.

Amended Regulations of the Dairy Produce Acts.

Although a cooler type of dairy house has been prescribed by the new regulations governing production on the farm, every existing dairy house will not be condemned forthwith. If it is found to conform reasonably with requirements it will be passed, provided that the new method of ventilation is adopted. For instance—the new regulations provide for the use of wire-netting or $\frac{1}{4}$-inch woven wire for ventilation in place of the very closely-woven wire or gauze hitherto commonly used. All new buildings must comply with the new regulations.

Much inferior quality cream has been due to lack of cleansing equipment on the farm, and provision has been made for the installation of a hot water boiler, washing-up trough, and draining rack. For dairies using milking machines extra safeguards have been introduced in order to protect the milk from possible contamination where separating is done in rooms adjacent to the bails. Dairymen supplying milk to a cheese factory or for local consumption may be spared the expense of building what will be known as Dairy House A, but, instead, must provide a milk stand—a small enclosed platform three (3) feet from the ground. A cheaper building, known as Dairy House B, for washing and storing utensils must, however, be provided. A dairyman must use the buildings on his premises for the purposes prescribed, and must not allow stock within thirty (30) feet of a dairy house or milk stand. It will be necessary to provide a shelter shed to protect cream awaiting collection from the sun. No person shall collect cream from any other shed wthout the approval of a dairy inspector.

Cloths and receptacles must be used for cleansing the teats and udders of the cows at the bails at the time of milking, and cleansed thoroughly after each milking. Every person must be clean and wear clean clothes when milking and in the dairy. All milk provided for any purpose must be strained and cooled in an approved way. When milk or cream is kept in a dairy house, it must be protected from dust and insects and stirred every four (4) hours with a metal stirrer. Milk must be delivered to a cheese factory before 9 a.m. in the summer, and 9.30 a.m. in the winter.

The time by which the cleansing of the milking shed and utensils must be completed has been fixed. Cans returned from the factory must be scalded before being used again. All cans must be marked with a registered number allotted and the number of the can. It is illegal for any person to use a can owned by another person. Any conveyance used for the carriage of cream or milk shall comply with the regulations, and such conveyance shall be cleansed thoroughly after each time it is used. Milk being conveyed to a cheese factory must be covered, and any milk not so covered shall be rejected. A conveyance for the sale or delivery of milk has been prescribed, and provision has been made for the protection of protruding milk taps from dust by an approved cover.

Provision has been made to hold samples of cream for check testing at a factory. The owner of the factory must notify the supplier immediately any cream is below first grade or the prescribed standard of butter fat.

Milk delivered by every supplier to a cheese factory shall be tested not less than four times per month. The samples shall be held in numbered composite bottles and kept in a locked cupboard.

Every owner of dairy produce premises who prepares curd or casein shall provide a detached room constructed and used for the purposes prescribed. All skim milk to be used must be conveyed to the curd-preparing room in a manner approved, but any can used for cream or milk shall not be used for carrying the skim milk to the curd room. The whey must be removed from the room daily. The buildings, plant, and utensils must be kept in a clean and sanitary condition. Standards have been prescribed for the manufacture of cans.

Increasing Pineapple Yields by Closer Planting.

Pineapple plants are able to get along with relatively small quantities of water, provided the soil around their roots is kept moist. Since the pineapple is a shallow-rooting plant, this very desirable objective can be obtained by shading the soil around the bases of the plants. Reducing evaporation of soil moisture in this way is one of the chief advantages to be gained from the use of paper mulch. Where paper mulch is not available, or where its use is precluded for economic or other reasons, conservation of soil moisture in pineapple fields can be readily and efficiently effected by setting the plants closely together. It has been found from experiment that the shading of the soil, which is effected by the foliage of closely set plants, conserves almost as much moisture as the plants grown therein require for transpiration, indicating that the rate of water loss from the unshaded soil between the rows is greater than that from soil shaded by the plants. In the light of these considerations, it will be clear that pineapple yields can be markedly increased by increasing the number of plants per acre, provided always that such factors as sunlight, rainfall, and soil properties are favourable for the proper development of a greater plant population. It should be borne in mind, however, that increasing the number of plants per acre likewise increases the drain on the nutritional sources of the soil in which they are grown, and consequently correspondingly heavier applications of fertilizer are necessary.

A great deal of experimental work has been carried out in Hawaii to determine the best planting systems for pineapples. In general, it has been found that increasing the number of plants per acre tends towards a decrease in fruit size, but leads to marked increases in yields. Fruits from widely-spaced plants, while large in size, are prone to be irregular in shape, and they show an increased tendency towards multiple and fasciated tops, and to the incidence of such diseases as brown speck and fruitlet core rot.

From a consideration of all of the factors involved, it is recommended that on the sandy soils of the coastal areas pineapple plants should be set out at the rate of from 14,000 to 16,000 per acre, while for heavier soils at higher altitudes and for regions of relatively heavy rainfall a smaller plant population of from 10,000 to 11,000 per acre is likely to prove more satisfactory.

The rate of water loss from sandy soils in sunny localities is relatively high, and consequently closer planting is recommended, because of the increased need for shading the soil. For heavier, colder soils and for cloudy regions, however, a slightly wider spacing of the plants is desirable, in order that sunlight may penetrate between the leaves, so that drying of the soil after excessively wet periods is facilitated, and a soil temperature favourable to root development is maintained.

During recent years many different systems of plant spacing have been tried out, and while certain advantages may be claimed for three and four-row systems, under special conditions, it is now generally agreed that the double-row system affords most of the advantages of other systems with few of their drawbacks. Under this system, each plant can be conveniently weeded, fertilized, and harvested from the passage-way between the rows. Moreover, each plant is afforded uniform exposure, there being no "inside plants," as with three or four-row systems. In these latter systems, the plants of the inside rows are apt to suffer severely from shading by their stronger neighbours of the outside rows. While shading of the soil is desirable and distinctly beneficial, shading of the leaves is definitely harmful, as it may delay blossoming for twelve months, and inevitably leads to the production of small, late-maturing fuit of poor quality.

On second-cycle (replanted) fields, the spacing of double-row beds, centre to centre, should be about 5 feet 6 inches, with a 22-24-inch spacing between the two rows of each bed. This would leave a 3-feet 6-inch passage-way between the beds, which is of ample width for carrying out cultural, fertilizing, and harvesting operations. If the plants were spaced 1 foot apart in the rows, the number which could be set out per acre would be in excess of 15,000. By spacing the beds on 6-feet centres, as should be done on new land, but maintaining the same distances between the rows and between the plants in the rows, the number of plants required for an acre would be approximately 14,000. In wet or cloudy districts, the beds should be laid out on 6-feet centres, but while the spacing between the rows would remain the same as for sunnier areas, namely 22-24 inches, the distance between the plants should be increased to 18 inches. This would give a population of about 10,000 plants per acre. Proper spacing of plants in the rows can only be accomplished by the use of a cord or wire marked at the appropriate distances; in the absence of some such guide, the tendency is to plant at wider spacings than those intended, with the result that the number of plants per acre falls short of requirements.

Provided subsequent cultural and fertilizing operations are properly carried out, the yields which may be obtained from close planting systems greatly exceed those being secured from existing wide-centre systems. A first crop yield of approximately 50 tons per acre is theoretically possible from a population of 16,000 plants per acre; the fact that in excess of 40 tons per acre has been harvested from the first crop (plant crop) on a 400-acre field in Hawaii, planted at the rate of 16,000 plants per acre, clearly demonstrates the benefits of closer planting.

Lice and Mites in Pigs.

When pigs are seen frequently rubbing against convenient objects in their run, or when the skin is rough and scaly, particularly on the head, neck, and shoulders, skin parasites should be suspected.

Lice and mange mites are the common external parasites of the pig which cause the above symptoms. Lice measure up to about one-quarter of an inch in length, and as they occur on the skin surface are very readily seen. The mange mites, on the other hand, are extremely minute in size, being only about one-fiftieth of an inch long, and as they live under the skin surface the aid of the microscope is necessary to find them.

Both lice and mites cause considerable irritation, preventing the animal from making normal growth, and by lowering its vitality make it readily susceptible to other diseases. The mange mites cause the skin to become roughened, thickened, and thrown into folds, and unless their spread is controlled they are quite capable of causing death.

Parasitic mange is readily contagious, and all affected animals should be immediately isolated. After a thorough washing with warm soapy water, the animal should then be covered with crude oil, which is best applied by hand on a cloth. This disease may, when in an advanced stage, become very obstinate to treatment, and numerous applications of oil at frequent intervals may be necessary to effect a cure.

Crude oil is also very effective against lice, but as the first application does not kill the eggs, a second application should be made after an interval of fifteen days.

Pigs should be oiled in the evening, as exposure to the sun immediately after oiling, especially in white breeds, may cause blistering of the skin.

Where mange is suspected, scrapings from the affected areas should be taken. The scrapings should be made from the newer areas of infection, being sufficiently deep to cause the appearance of blood, and then forwarded in tightly-corked tubes to the Animal Health Station, Yeerongpilly.

Soil Conservation.

Soil conservation has within recent years become a problem of major importance to the various States of the Commonwealth, and it is satisfying to observe that a consciousness has been awakened in respect of soil drift in the arid areas of the Commonwealth and erosion in general in the various States.

Recently the Commonwealth Council for Scientific and Industrial Research appointed an officer to undertake preliminary investigations into the problem of soil drift, and this officer has just completed an initial survey of the north-eastern portion of South Australia and embodied his findings in a report issued by the Council for Scientific and Industrial Research. The effects of overstocking accentuated by climatic conditions have been stressed in the report, which emphasises the idea that although the problem is a botanical one the solution lies largely in the administrative field. The Commonwealth officer is now continuing his investigations in the south-western corner of Queensland, and is being assisted on the botanical side by the Government Botanist and the Walter and Eliza Hall Fellow in Economic Biology of the University of Queensland, who is accompanying the Commonwealth officer in the field. The Department of Agriculture and Stock is assisting in every possible way this investigation, which is of outstanding importance to the future of the arid areas of the Commonwealth. The results of the present investigation, which is based on an arrangement made between the Commonwealth Council and the Queensland Department of Agriculture and Stock, will be awaited with great interest.

Another problem—that of soil erosion, gullying, &c.—is also engaging the attention of the Department of Agriculture and Stock. Experiments are being initiated in certain parts of the coastal areas by an Experimentation Committee appointed by the Minister. The importance of this problem to the conservation of agricultural and orchard lands is fully realised. The Department is, further, maintaining contact with the investigations being carried out in other parts of the world, and notably with those of the Soil Conservation Service of the United States of America.

The Value of Strain in Pasture Plants.

Many of the cultivated pasture plants with which farmers and graziers are familiar are now grown in countries far removed from their original homes. Rhodes grass, for instance, is a native of Africa and which, within the last forty years, has been distributed to all other continents. It is only to be expected that, in course of time, the type developed in one particular area should differ in some respects from a type developed under different conditions of soil, climate, or management. In the case of Rhodes grass, for example, pastures raised from Queensland-grown seed are superior, even in Africa, to pastures developed from African seed. As a matter of fact, large quantities of Queensland seed of Rhodes grass are annually exported to Africa. These different types are known as ''strains.''

What is true of Rhodes grass applies also in varying degrees to many other grasses and clovers, as well as to lucerne. In a number of countries which are well advanced in pasture research (for example, New Zealand and Great Britain) a great deal of attention has been paid to the differences in pastures developed from various lines of seed. Commercial and other lines of seed of the locally important species have been collected from many local and foreign sources, tested against one another under field conditions, and the lines producing the best pastures traced back to their respective origins.

Such trials on recognised testing stations have resulted in the seed market being supplied with lines of seed certified by responsible authorities to be superior for sowing purposes to certain other lines. Thus we have New Zealand Government certified perennial ryegrass, cocksfoot, and white clover seeds, &c. In some instances the preliminary testing station trials have been dispensed with, and certification accorded seeds from pastures known to be long-lived. New South Wales Government certified seed of *Phalaris tuberosa* is of this nature.

None of the grasses embraced in the seed certification schemes of other States and countries is as yet grown for seed purposes in Queensland; consequently the activities of the Queensland Department of Agriculture and Stock have been directed towards the testing of certified strains from other regions against one another and against uncertified strains. This work has revealed the following seeds to be very suitable for local use:—

Perennial Ryegrass—New Zealand Government certified permanent pasture.
Cocksfoot—New Zealand Government certified Akaroa.
Phalaris tuberosa—New South Wales Government certified.
White Clover—New Zealand Government certified.

Orchard Notes

FEBRUARY.

THE COASTAL DISTRICTS.

FEBRUARY in coastal Queensland is frequently a wet month, and, as the air is often heavy with moisture and very oppressive, plant growth of all kinds is rampant, and orchards and plantations are apt to get somewhat out of hand. Where green cropping is not practised it is not always possible to keep weed growth in check by means of cultivation. At the same time, the excessive growth of weeds provides a large quantity of organic matter which, when it rots, tends to keep up the supply of humus in the soil, so that, although the property looks unkept, the fruit-producing trees and plants are not suffering, and the land is eventually benefited. When the weed growth is excessive and there is a danger of the weeds seeding, it is a good plan to cut down the growth with a fern hook or brush scythe and allow it to remain on the ground and rot, as it will thereby prevent the soil from washing, and when the land is worked by horse power or chipped by hand it will be turned into the soil. This is about the most satisfactory way of dealing with excessive weed growth, especially in banana plantations, many of which are worked entirely by hand.

The main crop of smooth-leaf pineapples will be ready for canning, and great care must be taken to see that the fruit is sent from the plantation to the cannery with the least possible delay and in the best possible condition. The only way in which the canners can build up a reputation for Queensland canned pineapples is for them to turn out nothing but a high-class article. To do this they must have good fruit, fresh, and in the best of condition.

Bananas for shipment to the Southern States should on no account be allowed to become over-ripe before the bunches are cut; at the same time, the individual fruit should be well-filled and not partly developed. If the fruit is over-ripe it will not carry well, and is apt to reach its destination in an unsaleable condition.

Citrus orchards require careful attention, as there is frequently a heavy growth of water shoots, especially in trees that have recently been thinned out, and these must be removed. Citrus trees can be planted now where the land has been properly prepared, and it is also a good time to plant most kinds of tropical fruit trees, as they transplant well at this period of the year.

A few late grapes and mangoes will ripen during the month, and, in respect to the latter, it is very important to see no fly-infested fruit is allowed to lie on the ground but that it is gathered regularly and destroyed.

Strawberries may be planted towards the end of the month, and, if early ripening fruit is desired, care must be taken to select the first runners from the parent plants, as these will fruit quicker than those formed later. The land for strawberries should be brought into a state of thorough tilth by being well and deeply worked. If available, a good dressing of well-rooted farmyard manure should be given, as well as a complete commercial fertilizer, as strawberries require plenty of food and pay well for extra care and attention.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

THE marketing of later varieties of peaches and plums and of mid-season varieties of apples and pears, as well as of table grapes, will fully occupy the attention of fruitgrowers in the Granite Belt, and the advice in these notes for the two previous months with regard to handling, grading, packing, and marketing is again emphasised, as it is very bad policy to go to all the trouble of growing fruit and then, when it is ready to market, not to put it up in a way that will attract buyers.

Extra trouble taken with fruit pays every time. Good fruit, evenly graded and honestly packed, will sell when ungraded and badly packed fruit is a drug on the market. Expenses connected with the marketing of fruit are now so high, owing to the increased cost of cases, freight, and selling charges, that it is folly to attempt to market rubbish.

During the early part of the month it will be necessary to keep a careful watch on the crop of late apples in order to see that they are not attacked by codling moth. If there is a slightest indication of danger, a further spraying will be necessary, as the fruit that has previously escaped injury is usually that which suffers the most.

Fruit fly must also be systematically fought wherever and whenever found, and no infested fruit must be allowed to lie about on the ground.

Grapes will be ready for market, and in the case of this fruit the greatest care in handling and packing is necessary. The fruit should never be packed wet, and, if possible, it is an excellent plan to let the stems wilt for a day at least before packing. This tends to tighten the hold of the individual berries on the stem and thus prevent their falling off.

In the western districts winemaking will be in progress. Here again care is necessary, as the better the condition in which the fruit can be brought to the press the better the prospect of producing a high-class wine.

Where necessary and possible citrus trees should be given a good irrigation, as this will carry on the fruit till maturity, provided it is followed up by systematic cultivation so as to retain a sufficient supply of moisture in the soil.

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ECONOMY IN DAIRY PRODUCTION.

A measure of economy which involves the dairy farmer in very little extra work is to increase production by systematic herd testing and culling, and breeding only from the best producers.

Far too many herds include cows whose production falls far below average, and the dairy would be run far more economically if these cows were fattened for the butcher. They belong to the ''boarder'' class, and usually consume more fodder than a heavy producer. Too many animals of this class impair the efficiency of the farm.

No matter how close a watch is kept, it is almost impossible to pick the lowest producers without systematic testing over the whole lactation period. If the farmer is prepared to do this himself well and good, but he requires to have an accurate knowledge of testing and the principles involved in calculating results.

The Department of Agriculture and Stock offers a herd-testing service which involves the dairyman in no monetary expenditure whatsoever. In other States and countries up to 6s. per cow is paid for a similar service. Surely it is impossible to believe that dairy farmers in other parts pay for something that is valueless.

In Queensland many dairymen have availed themselves of the services offered, and the results achieved by those who have tested and culled over a number of years have proved that it is well worth while. Nevertheless, there are very many more who could do so to their own advantage.

To obtain this service it is only necessary to make application to the Department. Sample bottles in a box are sent to the farmer, and all he has to do is to weigh each cow's milk and place a sample in a bottle, as directed. Then, if the factory he supplies is co-operating with the Department, he forwards the box of bottles containing the samples to that factory. Otherwise he may send his samples direct to the Department of Agriculture and Stock, which pays the rail freight.

The testing is done five times at intervals of, approximately, sixty days, and at the end of the period the farmer receives a complete return showing the relative value of each cow under test. It must be remembered that the object of testing is not so much to find out the best cows in the herd as to find out the worst and least profitable.

Testing is only half the job, and the Department depends on the good sense of the farmer to see that he does not keep feeding unprofitable cows indefinitely. Testing is of no value in raising the standard of production of the herd unless the low producers are culled regularly.

It is a poor farm that cannot afford to dispose of the two least profitable cows each year. Remember the first loss is the least. The longer the ''boarders'' are kept the more expensive they become. They eat the feed of a good milker and much time is wasted, frequently, in rearing their calves, which turn out no better producers than the dams.

Farm Notes

FEBRUARY.

REFERENCE was made in last month's Notes to the necessity for early preparation of the soil for winter cereals, and to the adoption of a system of thorough cultivation in order to retain moisture in the subsoil for the use of crops intended to be raised during the season. The importance of the subject, and its bearing in relation to prospective crop yields, is made the excuse for this reiteration.

Special attention should be given to increasing the area under lucerne (broad-leaf Hunter River) wherever this valuable crop will grow. Its permanent nature warrants the preparation of a thorough tilth and seed-bed, and the cleansing of the land, prior to sowing the seed, of all foreign growths likely to interfere with the establishment and progress of the crop. Late in March or early in April is a seasonable period to make the first sowing providing all things are favourable to a good germinatior of seed.

Dairymen would be well advised to practise the raising of a continuity of fodder crops to meet the natural periods of grass shortage, and to keep up supplies of succulent fodder to maintain their milch cows in a state of production.

Many summer and autumn growing crops can still be planted for fodder and ensilage purposes. February also marks an important period as far as winter fodder crops are concerned, as the first sowings of both skinless and cape barley may be made at the latter end of the month in cool districts. Quick-growing crops of the former description, suitable for coastal districts and localities where early frosts are not expected, are Sudan grass, Japanese and French millet, white panicum, liberty millet, and similar kinds belonging to the Setaria family. Catch crops of Japanese and liberty millet may also be sown early in the month in cooler parts of the State, but the risk of early frosts has to be taken.

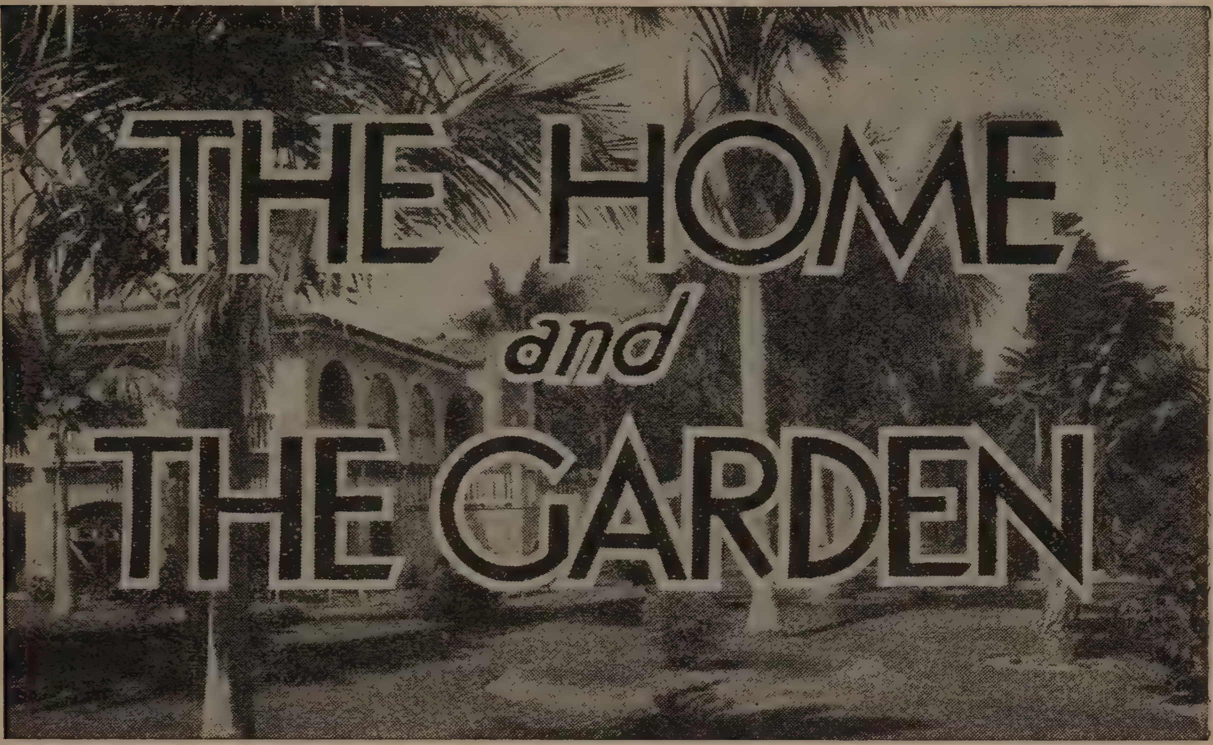
Maize and sorghums can still be planted as fodder and ensilage crops in coastal districts. In both coastal and inland areas, where dependence is placed largely on a bulky crop for cutting and feeding to milch cows in May and June, attention should be given to Planters' Friend (so-called Imphee) and saccaline.

In most agricultural districts where two distinct planting seasons prevail, the present month is an excellent time for putting in potatoes. This crop responds to good treatment, and best results are obtainable on soils which have been previously well prepared. The selection of good ''seed'' and its treatment against the possible presence of spores of fungoid diseases is imperative. For this purpose a solution of 1 pint of formalin (40 per cent. strength) to 24 gallons of water should be made up, and the potatoes immersed for one hour immediately prior to planting the tubers. Bags and containers of all kinds should also be treated, as an additional precaution. ''Irish Blight'' has wrought havoc at times in some districts, and can only be checked by adopting preventive measures and spraying the crops soon after the plants appear above the ground. Full particulars on the preparation of suitable mixtures for this purpose are obtainable on application to the Department of Agriculture, Brisbane.

Weeds of all kinds, which started into life under the recent favourable growing conditions, should be kept in check amongst growing crops; otherwise yields are likely to be seriously discounted. The younger the weeds the easier they are to destroy. Maize and other ''hoed'' crops will benefit by systematic cultivation. Where they are advanced, and the root system well developed, the cultivation should be as shallow as possible consistent with the work of weed destruction.

First sowings may now be made of swede and other field turnips. Drilling is preferable to broadcasting, so as to admit of horse-hoe cultivation between the drills, and the thinning out of the plants to suitable distances to allow for unrestricted development. Turnips respond to the application of superphosphate; 2 cwt. per acre is a fair average quantity to use when applied direct to the drills.

Where pig-raising is practised, land should be well manured and put into good tilth in anticipation of sowing rape, swedes, mangels, field cabbage, and field peas during March, April, and May.



OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

HOLIDAY TRAVELLING.

Travelling with a baby and several small children is no holiday for their mother. Unless she plans everything carefully beforehand, a long train journey may end with an exhausted mother and a handful of cross, tired, over-fed children, who will be sick for the next few days. Perhaps a little advice at this season of the year may be helpful.

Food.

It is most important that this should be carefully considered beforehand. The breast-fed baby who has been properly managed should give no trouble at all. But it is not so with the bottle-fed infant. We have seen many who have been seriously upset by milk which has gone bad in the train, especially in hot weather. It is true that there are ways of carrying the baby's milk safely. But these require so much care and understanding, and the consequences of any mistake may be so serious, that we cannot advise them. Nor can we advise the mother on a journey to buy milk at the railway stations. Much the safest plan is to carry a supply of good dried milk (Glaxo or Lactogen)—not, of course, dried skimmed milk. Boiling water is always procurable, and it may also be carried in vacuum flasks, so that it is always possible to scald the bottles and teats, and to make up the feeds for each meal. Any milk left after a feed should be thrown out at once—never left in the bottle. It is well to carry more than one bottle and teat. These should be wrapped in clean boiled butter muslin and carefully packed in a tin. Though the baby may not be used to dried milk, it will do him no harm, provided it is not made too strong. It will be wise to make it up rather weaker than advised on the tin. At the end of the journey, when good fresh milk is procurable, he will soon make up for having been on a rather weak mixture for one or two days.

For the toddler avoid bought foods, cakes, and sweets, which may do him much harm especially as the novelty and excitement will very probably have weakened his digestion. Remember that a day of rather short rations will do him no harm but a day of over-feeding may go a long way to spoil his holiday and your own too! Carry your own provisions. Pack a tin with some slices of baked bread and oatcake, which may be ready buttered, and some sandwiches, preferably of wholemeal or cerevite bread. These may contain lettuce, sliced tomatoes, egg, either sliced or scrambled, or soft cheese spread on butter, or marmite. Add a few dates or seedless raisins, apples or oranges, and you have all the solid food necessary. He may drink dried milk dissolved in hot water, like his baby brother, or you may carry one or two lemons with a small packet of sugar, which will make a drink he will surely relish. Let him have his little picnics at the right times, but don't try to keep him quiet by feeding him all the time. You won't succeed; it will only make him cross and irritable, miserable himself, and a torment to others. But let him have a drink of water when he wants it.

Amusement.

Most children will be interested in looking out of the window until they are tired, but don't let them tumble out. It may be well to carry a few simple toys and picture books and writing pad and a pencil.

Clothing.

You won't need to carry much wraps in the summer, but a light rug and cushion will be useful. For the baby have a plentiful supply of napkins, and some old newspapers or a mackintosh bag for the wet napkins.

Rest and Sleep.

These are important if over-fatigue and fretfulness are to be avoided. A dress-basket is most useful for a young baby. Properly managed, he will sleep or lie awake in this quite contented, and much happier than if constantly nursed in the arms of an over-heated and exhausted mother.

If you have trained your children well, you will reap your reward when travelling. How sad it is to see children in the train scrambling over everything, eating an endless supply of cakes and sweets, grubby and tired, ignoring their mother's efforts at control, and finally fretful and crying from sheer exhaustion and discomfort!

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IN THE FARM KITCHEN.

VALUE OF ORANGES AND MANDARINS.

Oranges and mandarins are not acid-forming. On the contrary, they are alkaline in reaction, and serve to balance the recognised staple foods which are acid-forming and which, if used too freely, result in acidosis, a forerunner of many common ailments which often lead to dangerous disorders. Medical opinion on their value is quoted as follows:—

Sir William Arbuthnot Lane, Bart, C.B., M.S., F.R.C.S., etc. (England):—

> "An orange is a perfect beginning to a meal. The minimum amount daily to prevent scurvy is one ounce of orange juice."

W. D. Sansum, M.A., M.D. (America):—

> "Oranges have an alkaline reaction in the blood which offsets the acidity caused by such good foods as meat, fish, eggs, cereals, and bread."

In a questionnaire sent to 118 child specialists by the California Fruit Growers' Exchange, asking what fruits they recommend most often for children under three years of age, 93 out of the 107 who replied simply wrote "oranges." Some of the reasons they gave for this choice were:—

> Orange juice is easily digested. Its salts and acids form the best natural mild laxative that physicians know. It is a preventive of children's disorders due to sterile or deficient food. It has a naturally corrective medicinal diet; and, not to be overlooked, all children like oranges. Orange juice helps to build up a sound, healthy bone-and-muscle structure, and gives the body the right start.
>
> It is particularly helpful in building good tooth structure. Aside from its regularity benefits, orange juice supplies a necessary element to growth—vitamins.

The value of orange juice is stressed in all advice given with regard to the feeding of babies, beginning with a teaspoon a day diluted with an equal quantity of water, as early as the sixth week. For the artificially fed baby, orange juice is of even greater importance.

The value of oranges and mandarins may be summarised:—

1. Being rich in vitamin A, they help to resist infection of the eye, nose, and throat.

2. Rich in vitamin B, they promote growth and are consequently particularly valuable for young children.

3. They offer an abundant supply of the antiscorbutic vitamin C, the food factor most likely to be wanting in the ordinary diet, and the lack of which is often the cause of scurvy, retarded growth, malnutrition in children, bone and growth development, anæmia, &c.

4. They are alkaline in reaction and prevent acidosis.

5. They stimulate the appetite.

6. They are mildly laxative.

7. They contribute to the diet potash, calcium, phosphate, and iron.

8. They aid digestion.

9. They contain a large percentage of natural fruit sugar which provides energising food value in an easily assimilated form.

The above are nine excellent reasons for the inclusion of oranges and mandarins in the daily diet. The tenth, and from a family point of view, not the least important, is the deliciousness of the fruit itself.

What youngster does not appreciate mandarins, and how ideal and hygienic are these for inclusion in school lunches.

Oranges and mandarins will often tempt the appetite of the sick and convalescent when other foods fail to appeal.

Remember, the body cannot store some of the health factors required by it, and it is necessary to replace them at frequent intervals. Therefore, during the season buy oranges and mandarins freely so that old and young alike can have them daily.

Schools or consumers not in close touch with retailers will, on application to the Committee of Direction, be supplied with a list of growers prepared to forward oranges and mandarins direct to country customers.

Besides being ideal for eating fresh, oranges and mandarins may be used for household purposes in a multiplicity of ways, e.g.:—

Orange Delight.

Take 5 oranges, 1 teacupful of white sugar, 1 pint milk, 3 eggs, 1 tablespoonful of cornflour. Peel the oranges, cut. Heat the milk by letting it steam in a saucepan of boiling water, add the cornflour, mixed smooth with a little milk, and the well-beaten eggs. Sweeten, stir till thick, pour over the oranges, and beat ½ pint cream. Sweeten, flavour with orange juice and a little grated rind piled on top of the custard, then into slices, removing the pips, and sift sugar over them.

Jellied Oranges Cut in Sections.

Remove a piece 1 inch in diameter from the navel ends of oranges. Remove juice and pulp with a teaspoon, and strain through cheese cloth. With first two fingers take out as much as possible of the white inner membrane from the orange skin. Use juice to make orange jelly, and fill orange skins. Place in upright position in a pan of crushed ice and leave until firm. Cut in halves, then in thirds, and serve with or without whipped cream.

Orange Snow.

Dissolve an ounce of isinglass in a pint of boiling water, strain and let it stand till nearly cold. Mix it with the juice of 6 or 7 oranges and 1 lemon, add the white of 3 eggs, and sugar to taste, whisk all together until like a sponge, put into a mould and turn out the following day.

Orange Roly-Poly.

Two cups flour, 4 teaspoons baking powder, 1 teaspoon salt, 4 tablespoons butter, ¾ cup milk, ½ cup sugar, 4 oranges, grated rind 1 orange, ½ cup water.

Mix and sift flour, baking powder, and salt. With tips of fingers rub in two tablespoons butter, and mix to a dough with milk. Roll out one-half inch thick, and cover with small pieces of orange pulp. Mix sugar, orange rind, and remaining butter, and sprinkle two-thirds of it over the orange. Roll up; pinch ends together; place in baking dish; sprinkle with remaining sugar, surround with water, and bake about thirty minutes. Serve with an orange or lemon sauce.

Creamy Pudding Sauce.

1 egg, ¾ cup powdered sugar, 1 cup cream, 2 tablespoons orange juice, 1 tablespoon lemon juice.

Beat egg until light; beat in powdered sugar. Add cream, whipped until stiff, and fruit juices.

Orange Cream Custard.

Four oranges, 2 eggs, ½ cup sugar, 2 teaspoons flour, ⅛ teaspoon salt, 2 cups milk, ½ teaspoon vanilla, 5 tablespoons sugar.

Beat egg yolks, add one-quarter cup sugar, flour and salt, and mix thoroughly. Add milk and cook in double boiler until thick enough to coat spoon. Cool, add vanilla, and turn into serving dish containing peeled and sliced oranges. Beat egg whites with five tablespoons sugar. Heap on top of custard and serve.

Orange Fritters.

Peel and core the oranges, cut in slices, roll in sugar, dip in batter and fry.

Batter for the above:—Two eggs, 2 tablespoonfuls flour and a little milk. Mix thoroughly and smoothly before dipping the orange slices in. Other fruit may be used in the same way.

Tangerine Delight.

Two cups of pure crystal sugar, 1 cup strained orange juice, 3 dessertspoonfuls powdered gelatine, 1 dessertspoonful vanilla. Bring orange juice to boiling point, pour over the sugar and gelatine, mix well. When cool add essence and beat for 12 minutes very quickly. Set in a buttered tin. When firm cut in blocks and roll in icing sugar.

Orange and Passion Fruit Snow.

Two dessertspoons gelatine, 1 cup orange and passion fruit juice, ½ cup hot water, ½ cup cold water, 3 tablespoons sugar, 1 egg white beaten stiff.

Dissolve gelatine and sugar in hot water, add cold water and fruit juice (add more sugar if necessary.) Leave until thickened, beat with an egg whisk until thick, gradually add egg white and beat until the mixture holds its shape.

Orange Cake.

4 eggs, 8 oz. flour, 8 oz. sugar, 7 oz. butter, juice and rind of two oranges, 3 tablespoons milk, 1 teaspoon good baking powder.

Cream butter and half sugar, add the other half of sugar to eggs. Beat eggs and sugar until spongy, then add to the butter. Mix very lightly, add juice and rinds. Sift flour, with baking powder, and add milk, mix well and bake in moderate oven for 1 hour. (Or bake in sandwich tins.) Ice when cold.

Fruit Sponge.

Juice of two oranges, 1 lemon, 6 passion fruit, 1 cup sugar, 1 heaped tablespoon powdered gelatine, 1 tablespoon flour, 2 cups water.

Mix flour with a little water, dissolve gelatine in half cup water, put all ingredients except passion fruit in a saucepan and bring to boil. When nearly cold beat until nearly stiff, then add passion fruit and put in mould; serve with cream.

Mandarin Cake.

1 lb. flour, ½ lb. butter, ¾ lb. sugar, 3 eggs, 1 cup milk, 2 teaspoons baking powder, 1 teaspoon salt, 2 mandarins.

Beat butter and sugar to cream, add eggs one by one and beat each well as it goes into the mixture. Sift flour, baking powder, and salt, mix with butter and eggs alternately with the milk. Grate the rind of the mandarins and put into the mixture. Put into tin and bake about an hour and quarter. Ice with ¾ lb. icing sugar mixed with 3 tablespoons mandarin juice and just warmed over fire.

Mandarin Filling.

One mandarin, 1 tablespoon cornflour, ½ pint water, 2 oz. butter, 2 oz. sugar.

Put water and butter on to boil, stir in moistened cornflour, add sugar, and stir till thickened, add grated rind and juice of mandarin, cool, and put between sandwich.

PAPAW RECIPES.

Papaw Preserve.

Take 1 lb. of sugar, ½ pint of water, to make a syrup, 2 tablespoonfuls of lime, and a gallon water. Put the lime into the water, and stir until dissolved; peel the fruit, and cut into slices about 2 inches thick and the length of the fruit. Put these pieces into the lime water and allow to remain for about 8 to 10 hours; then take the fruit out, make the syrup, and when boiling put in the papaw; boil quickly for half an hour; take out the fruit and arrange lengthwise in a glass jar. When the syrup is cool, fill the jar and cork down tightly.

Fruit Salad.

Take as many different fruits as possible—oranges, papaws, pineapples, apples, bananas, passion fruit, and the juice of a lemon. Cut bananas into thin slices, and papaws and pineapples into cubes, peel the apples and slice them in. Remove pith from oranges and slice them in. Sprinkle each alternate layer with sugar, squeeze over the juice of the lemon and the passion fruit. Serve with whipped cream.

Mixed Fruit Jelly.

Take 2 large apples, 3 bananas, a nice piece of papaw, a small piece of pineapple, and any other fruit you like. Cut it all up in nice, fine slices, squeeze passion fruit all over the top, sweeten a little, then make a pint of jelly, and when fairly cool pour over the fruit. This can be eaten with whipped cream or custard or served plain.

Papaw Dessert.

Cut up in rather large pieces, put in enamelled stewpan with about a pint or so of water to 3 lb. of fruit, 1 small teacupful of sugar, the juice of 2 lemons, bring to the boil and simmer for 10 minutes, set aside to cool, and serve with a milk pudding, or it may be set in jelly.

Papaw Salad.

By adding a little orange or lemon juice to diced or mashed papaw you can produce a lovely salad in a few minutes. This is the most inexpensive fruit salad possible and is simply delicious.

Tropical Fruit Salad.

Papaws, bananas, and pineapple combine to make a delicious tropical fruit salad. Use in quantities to suit taste, dicing the papaw and pineapple and slicing the bananas. Crush a little of the pineapple to secure juice and sprinkle this over whole with a little sugar, and serve.

Icy Fruit Slices.

Cut a papaw into sections lengthwise, sprinkle with lemon and sugar, and place in ice chest until thoroughly cold. When serving sprinkle with crushed ice if desired.

Crystallising Fruits.

Choose good sound fruit, not too ripe, and prick with a needle. Place in a pan of cold water and bring to the boil. The fruit will rise to the surface, and must be lifted out and placed carefully in cold water. Prepare a syrup by boiling 2 lb. of cane sugar in 1 pint of water till on dipping a skewer into the syrup and blowing through it bubbles will be formed on the other side of the skewer. Then put the fruit into the syrup and boil up. Remove the scum. Take the pan off the fire and pour contents into a basin. Leave till the next day, then pour off the syrup and boil till it threads. Pour over the fruit and allow to stand overnight. Repeat the process for four days and on the fifth day boil the syrup to the "crack," dip the fruit into it and drain on a sieve in a warm place. Sprinkle with fine sugar. Pack carefully and keep in a cool, dry place.

Papaw Tart.

One and a-half cups of self-raising flour, rub in 1 tablespoon of butter, add 1 teaspoon of sugar and a little salt. Mix with milk or water to make a light dough. Roll out thin, spread on a plate, prick all over, and fill with thinly sliced papaw sprinked with sugar and lemon juice or passion fruit. Cover with pastry and bake in a moderate oven.

Frozen Papaw Jelly.

Peel a firm fully ripe papaw, cut the end sufficiently to allow the removal of seeds. Dissolve jelly crystals, when cool pour into papaw cavity; place on ice and allow to set. Cut into rings and serve with whipped cream.

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VALUE OF PINEAPPLES.

Pineapples are undoubtedly one of nature's health correctives and healers. Their richness in vitamin A helps to prevent common colds and those eye ailments so prevalent amongst children, particularly in the inland districts of Australia. At the first sign of a cold or when colds are prevalent eat pineapples freely. Being rich in vitamin B, they promote body growth. Owing to their vitamin C content, pineapples are recommended by doctors as a precaution against pyorrhœa, which, according to the "Medical Press and Circular," is largely a dietary affection.

Dr. J. R. Killian, a distinguished American scientist, specialising in the study of nutrition, states that the fight against pyorrhœa and dental decay will be helped in the future by a liberal use of pineapple in the diet.

Pineapples are of great value in after treatment following tonsil removals, and assist the stumps to heal. The pure juice is a proved reliable ferment for dissolving necrosed tissue in quinsy.

These benefits are available to all, as where the fresh fruit is unobtainable the canned pineapple—retaining as it does the properties of the freshly-picked fruit—may be used.

Its uses in the kitchen are legion. Slices fresh or canned, served with cold meat have an appeal which ensures their continued use, particularly with corned meat. To the busy housewife the pineapple presents an easy solution of the ever-present dessert problem. No dish is more quickly prepared or more appetising than grated pineapple, fresh or canned. Its popularity never wanes.

A fruit salad can be rapidly made by the use of pineapple, fresh or canned, and one or more of any fruits in season. For cooked desserts the pineapple may be served in a multiplicity of ways, and the following recipes are recommended:—

Pineapple Jelly.

Wash a good half-breakfastcupful of sago, put in a large jug with half-cupful water, 1 cupful sugar, 2 grated pineapples, and juice of 1 lemon. Put the jug in a pan of boiling water and stir until clear, then put in moulds until cold. Serve with custard or grated pineapple.

Pineapple Fritters.

Put flour in basin, add pinch of salt, baking soda and cream of tartar, the usual quantities to each pound of flour, 1 tablespoonful sugar, and 1 egg to each pound of flour. Mix all together with milk, or half milk and half water, to a nice batter, dip in pieces of pineapple, and fry to a nice brown. Condensed milk may be used if fresh is not available for the batter, by mixing at the rate of 1 tablespoonful to a pint of cold water. This mixture of batter may be used for bananas, mangoes, or apples, or any fruit that is used for fritters.

Pineapple Pie.

Two cupfuls grated pineapple, 1 cupful water, cupful sugar, 2 tablespoonfuls breadcrumbs. Line pie-dish with paste, mix pineapple, water, sugar, breadcrumbs, and yolks of 2 eggs, bake, and when cool beat up the white of eggs and put over pie.

Pineapple Turnovers.

Make a flaky pastry from 2 cups of self-raising flour and half-cup dripping. Cut out shapes the size of a tea plate, put a spoonful of chopped pineapple and a little sugar on each fold, press over the edges of the pastry together, and bake in a brisk oven. The turnovers are better served with hot custard.

A delicious pineapple drink may be made in either of the following ways:—

Pineapple Syrup.

Keep the skins of your pineapples and boil slowly and well in plenty of water. Strain through cloth and add sugar to taste. This makes a delicious drink and retains all the medicinal qualities of the pineapple.

Pineapple Water.

Peel a medium-sized pineapple and cut it into pieces, pound it to a pulp, and mix with it 1 pint of boiling syrup and the juice of 1 lemon, and let it all stand covered for two hours; now strain, and add 1 quart of water, and ice.

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HOW TO MAKE SOAP.

Materials.

6 lb. clean dripping; 2 gallons water; 1lb caustic soda; ½ lb. resin; 3 tablespoons borax or kerosene.

Method.

1. Put dripping, resin, and water into a boiler or kerosene tin.
2. Boil until all fat is melted—15 to 30 minutes.
3. Add borax or kerosene; remove from fire.
4. Add caustic soda direct from the tin gradually, allowing bubbles to subside between each addition.
5. Boil gently for one or two hours.
6. Pour into a box lined with a damp cloth.
7. When solid, cut into bars and store in a dry place until hardened.

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RANCIDITY IN FRESH CREAM.

A rancid flavour in fresh cream is a most unexpected trouble with dairy farmers, as this defect is usually associated with old, stale cream. Each year, however, particularly from March to July, authentic reports are received of cream (less than twenty-four hours old) being degraded on account of rancidity.

A substance called lipase is the cause of the trouble. Lipase is an enzyme which occurs in milk and cream, and has the property of rapidly decomposing the fat. Its greatest damage is noticeable when cows are approaching the end of their milking period, and usually only one or two cows in the herd are responsible for the spoilage that occurs in the milk or cream.

When confronted with this trouble, farmers are advised to examine the milk from each cow until the offending animals are identified. This may be done by holding about half-a-cupful of milk from each animal for six or eight hours and tasting and smelling at intervals. A sickly, rancid smell and taste will signify the troublesome ones, and the milk from these cows should not be mixed with the bulk milk for separation.

The defect becomes worse hour by hour, and there is no way of stopping its action except by heating almost to boiling point. If such milk is desired for home use it should be boiled immediately it is drawn from the cow.

The Tropics and Man

INFLUENCE OF CLIMATE ON THE EUROPEAN.

DOUGLAS H. K. LEE, M.Sc., M.B., B.S., D.T.M.,—Professor of Physiology, University of Queensland.

No. 1.

"THE proper study of mankind is man," said Alexander Pope in a well-known poem. But I wonder, do we really appreciate what wonderful beings we really are, or do we study ourselves enough? Do we realize on the one hand what we are capable of accomplishing if only we set about it on the right lines, or, on the other, do we remember sufficiently often the extraordinary intricacy and delicacy of our body's mechanism? Those of us whose footsteps have been led by fate into such paths of enquiry might sometimes be temped to pride ourselves on our understanding of the human body, but is our understanding after all very complete, or, for that matter, do we practise ourselves the behaviour we order for others? Is it not usually the case that the medical man or nurse makes the worst patient?

The more closely I have been brought into contact with man's reactions to the various stresses forced upon him by tropical residence, the more I realise our profound ignorance of what hot climates alone do to him, that is, hot climates stripped of their usual accompaniments of infection, social obligations and economic peculiarities. At the same time, the realization of ignorance does not breed pessimism; rather does it appear that closer and more exact study of the actual position should point out how man can better triumph over the present disabilities imposed by hot climates and impose in turn his superiority upon nature in areas and ways as yet only toyed with by him. *But,* first must come knowledge. Action in ignorance or in unthoughtful defiance of nature can end only in disaster, even though its initial stages be tended with apparent success.

It has been pointed out many times by better writers than I, that tropical Australia as a whole, and Queensland in particular by virtue of its larger experience, forms a unique field for the investigation of tropical influences on the European. The position still remains. We still possess a "White Australia," we are still comparatively free from those infectious diseases so prevalent and so devastating in other tropical countries, and we are still conducting with success a mass experiment in European settlement of a tropical country. Many pioneer attempts have been made to assess the progress of this experiment, and the effects of this settlement upon the white race. These assessments are very valuable indeed and provide information with which to compare later information. They suffered, however, from two factors beyond the control of these able investigators—lack of co-ordination one with the other, and absence of much valuable information available to-day from other sources. We are now in a much better position to take up the investigations where these workers were compelled to lay them down. Through the generosity and foresightedness of the Government, Queensland has become possessed of a Medical School of its own, which in addition to training medical students and imparting to them a special interest in tropical medicine, has taken unto itself the keenest interest in the medical and allied human problems peculiar to the tropics. Organization of a large new undertaking is exacting and time-consuming, but already investigations have commenced and interesting considerations are emerging. From time to time in these pages, reference will be made to the progress of this work and hints given of what this work may mean for the average man in the Queensland tropics. As in the erection of a building, the preliminary work of research is of a mysterious character to those not conversant with the art, and little visible progress is made. Nevertheless, the foundations are the most important part and the more important the larger the subsequent edifice. There is a popular belief that professors, and indeed all University people, are peculiar persons given to burying their noses in abstruse problems out of touch with the realities of life, and to this belief is often attached an appeal to let the ''practical'' man decide what is to be done. The modern University in no way supports this conception, and to those who know the Queensland University and its courage in appointing youth to recent vacancies, such ideas are ludicrous. Mutual co-operation is the only path by which any State can be led to prosperity, and no group of people are more cognisant of this than the University Staff. National prosperity can be obtained only by national effort, and in this scheme all men must play their part.

Long-range success can be achieved only by long-range planning, and planning can go on intelligently only when adequate facts are available. These facts must cover every conceivable range of the problem, and if they are not available steps must be taken to make them available. Unfortunately, nature will seldom tolerate being overwhelmed with questions, but much prefers to be asked them one at a time in orderly sequence. There are two disadvantages in this, firstly that time and extensive personnel are required for this method, and secondly, separate answers when obtained, have to be fitted together again to make them relevant to the wide problem, a process by no means simple. Unfortunately, again, men are apt to lose patience with nature and discourse at length about her on the basis of very little evidence. The valuable contributions made by earlier investigators of tropical settlement in general and of Queensland's problems in particular suffered very much from hasty generalizations made on the basis of incomplete evidence. It is characteristic of scientific history that most observations have been quite correct, but that interpretations have been so ofter at fault. There can be no doubt that what the earlier workers reported was quite correct, but there can also be little doubt that a lot of the theory built up on that evidence—by no means at the hands of these workers alone—has never been verified. We must realize this, and recognise that we must return once more to *facts* and refuse to accept theory until it has been well tested, and then only to accept it until a better structure can be devised. All this may seem very airy and away from practical application, but I shall, in succeeding articles, frequently have cause to point out faults or weaknesses in present conceptions, and plead for a non-commital attitude until facts are forthcoming.

Granted a healthy doubt in unsubstantiated theories, how are we going to set about collecting the facts? The problem is so wide, and so inextricably mingled are the medical, physiological, economic and social factors that it would be a bold man who would categorically state that such and such is the only plan. I have had the opportunity of studying the problem fairly closely, and to me certain features stand out in relief, but to others viewing the terrain from a different angle, other features would no doubt be prominent. For this reason I would, in somewhat Hibernian fashion, put as the first point in my plan that several highly competent investigators with different outlooks should co-operate in the formulation of a plan. My own particular interests would for their part then pass to considering just what the effect of hot climates upon an unacclimatised man are, in order to provide a basis from which to work. The next point would be to compare with this the effect of similar climates upon fully acclimatised persons. Having establised both ends as it were, of this mysterious process of acclimatisation, one could investigate its nature with a little more confidence. Once this process was "taped," one should be able to give rational advice about encouraging and hastening it without involving the calamities that are at present liable to occur. All of this sounds fairly simple and straightforward, but nothing is so elusive as facts, and, in any case, before we start, what is a tropical climate, what are its important factors and how do they act? The next few articles will be devoted to examining just these facts which we so often take for granted, but which are really the whole cause of our trouble.

[TO BE CONTINUED.]

WHEN OVERLANDERS MADE HISTORY—GREAT DROVING FEATS RECALLED.

Of the greatest droving feats in Australian history, one is that which was effected by C. and W. Macdonald, of Clifford's Creek, Goulburn, New South Wales. Starting from The Junction, Tuena, with just over 1,000 head of cattle and 100 horses, to form Fossil Downs Station in partnership with the MacKenzie brothers, in Western Australia, and further supplemented by TYI cattle from Tininburra Station, Queensland, they arrived at their destination after having been three years on the road.

Only 13 horses of the 100 survived the trip, though most of the cattle arrived safely, and their brand, the Z/5, is still used by descendants of the MacKenzie family in New South Wales, as well as the Fossil Downs Station. One of the brothers who made the trip was later speared by blacks, and the other contracted pneumonia and died while returning on holiday to Goulburn.

The drover with consistently low loss tallies never wants for a job, and one of the best performances of this kind was put up by Jerry Conolly, a well-known Centralian drover, who started from the Northern Territory with 1,224 bullocks. After covering nearly 2,000 miles over notoriously bad country, he delivered the herd at Muswellbrook, New South Wales, only four short. These had been drowned in crossing a flooded river, and the rest were in first-class condition. The magnitude of this feat can be gauged when it is realised that trips such as this took many months, and sometimes years, to complete.

But in the droving history of Australia the performance which stands out from all others is the early trans-Commonwealth drive of Mick Durack and Tom Kilfoyle. Leaving Mount Marlow Station, Queensland, with 2,000 cows in 1883, they covered 2,500 miles, and arrived at the Ord River, Western Australia, two and a-half years later, in 1885.

Travelling over practically unknown country, menaced for the greater part of the journey by hostile blacks, stricken down repeatedly by fever, and encountering such troubles as long dry spells without water, hungry crocodiles waiting for them at every river crossing, they arrived with practically the whole of their herd intact. Their arrival has been recorded on a huge baobab tree on the bank of the Ord River, about 120 miles inland from Wyndham, and it has been preserved as a memorial to the feat.—Kingsley Temple, in "The Australasian."

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF NOVEMBER IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1936 AND 1935, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Nov.	No. of Years' Records.	Nov. 1936.	Nov. 1935.
North Coast.	In.		In.	In.
Atherton	2·42	35	0·37	1·25
Cairns	3·95	54	0·94	2·91
Cardwell	4·19	64	2·50	4·35
Cooktown	2·53	60	1·91	0·38
Herberton	2·62	50	0·36	1·80
Ingham	3·87	44	0·99	1·04
Innisfail	6·33	55	1·47	4·64
Mossman Mill	4·35	23	4·28	3·88
Townsville	1·88	65	2·48	0·37
Central Coast.				
Ayr	1·77	49	0·12	0·16
Bowen	1·29	65	Nil	0·37
Charters Towers	1·44	54	0·82	0·04
Mackay	3·12	65	0·38	0·81
Proserpine	2·95	33	0·29	0·81
St. Lawrence	2·42	65	1·04	0·15
South Coast.				
Biggenden	2·82	37	0·86	Nil
Bundaberg	2·70	53	3·34	0·15
Brisbane	3·78	84	1·35	1·26
Caboolture	3·53	49	2·41	0·48
Childers	2·79	41	1·74	Nil
Crohamhurst	4·91	43	2·60	1·76
Esk	3·26	49	2·27	1·61
Gayndah	2·97	65	0·99	0·05
Gympie	3·26	66	2·25	0·18
Kilkivan	2·58	57	2·50	0·10
Maryborough	3·23	65	2·09	1·52
Nambour	4·06	40	2·48	0·95
Nanango	2·76	54	1·81	0·16
Rockhampton	2·43	65	2·46	0·07
Woodford	3·28	49	2·05	0·71

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Nov.	No. of Years' Records.	Nov. 1936.	Nov. 1935.
Central Highlands.	In.		In.	In.
Clermont	2·04	65	0·16	Nil
Gindie	2·17	37	..	0·04
Springsure	2·26	67	0·10	0·05
Darling Downs.				
Dalby	2·79	66	0·78	0·58
Emu Vale	2·71	40	1·67	0·26
Hermitage	2·63	30	..	0·09
Jimbour	2·59	48	0·78	0·20
Miles	2·63	51	1·36	0·37
Stanthorpe	2·73	63	1·24	0·70
Toowoomba	3·33	64	1·59	0·39
Warwick	2·63	71	1·66	0·17
Maranoa.				
Roma	2·19	62	1·50	0·56
State Farms, &c.				
Bungeworgoral	2·53	22	1·03	Nil
Gatton College	2·95	37	3·00	0·31
Kairi	2·42	22	..	..
Mackay Sugar Experiment Station	2·86	39	0·35	0·79

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—NOVEMBER, 1936.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure Means at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.					
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·87	88	75	91	20	69	10	191	3
Herberton	..	84	60	93	16	52	10	36	3
Rockhampton	29·96	90	68	99	10	62	12	246	7
Brisbane	29·99	84	65	95	21	55	2	135	4
Darling Downs.									
Dalby	29·95	89	60	102	9	48	13	78	6
Stanthorpe	..	82	52	96	9	39	2	124	4
Toowoomba	..	83	56	96	7	43	2	159	7
Mid-Interior.									
Georgetown	29·87	98	72	105	19	58	1	86	4
Longreach	29·90	97	66	107	20	53	12	29	5
Mitchell	29·93	90	60	104	8	42	2	97	6
Western									
Burketown	29·86	97	74	105	18	65	24	33	3
Boulia	29·88	98	68	108	8	56	2	120	3
Thargomindah	29·92	94	65	109	7	53	12	Nil	..

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	January, 1937.		February, 1937.		MOONRISE. Jan., 1937.	MOONRISE. Feb., 1937.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	5·0	6·50	5·26	6·47	9·32	9·49
2	5·1	6·50	5·26	6·46	10·21	10·24
3	5·2	6·50	5·27	6·46	10·45	11·1
4	5·3	6·51	5·27	6·45	11·16	11·42
5	5·4	6·51	5·28	6·44	11·51	..
						a.m.
6	5·5	6·51	5·29	6·44	..	12·27
					a.m.	
7	5·6	6·52	5·29	6·43	12·27	1·15
8	5·7	6·52	5·30	6·42	1·2	2·11
9	5·7	6·52	5·31	6·42	1·47	3·8
10	5·8	6·52	5·31	6·41	2·35	4·10
11	5·9	6·51	5·32	6·40	3·28	5·10
12	5·9	6·51	5·33	6·39	4·24	6·12
13	5·10	6·51	5·33	6·39	5·28	7·14
14	5·10	6·51	5·34	6·38	6·21	8·14
15	5·11	6·51	5·35	6·37	7·21	9·18
16	5·12	6·50	5·35	6·37	8·22	10·21
17	5·13	6·50	5·36	6·36	9·21	11·32
						p.m.
18	5·14	6·50	5 37	6·35	10·32	12·36
19	5·14	6·50	5·37	6·34	11·26	1·37
20	5·15	6·50	5·38	6·33	12·29	2·30
21	5·16	6·49	5·39	6·32	1·35	3·21
22	5·17	6·49	5·39	6·31	2·40	4·12
23	5·18	6·49	5·40	6·30	3·42	4·54
24	5·19	6·49	5·41	6·29	4·40	5·33
25	5·19	6·48	5·42	6·28	5·34	6·8
26	5·20	6·48	5·43	6·27	6·17	6·41
27	5·21	6·48	5·44	6·26	6·59	7·14
28	5·22	6·48	5·45	6·25	7·36	7.47
29	5·23	6·47			8·10	
30	5·24	6·47			8·44	
31	5·25	6·47			9·18	

Phases of the Moon, Occultations, &c.

4 Jan.	☽ Last Quarter	12 22 a.m.
13 ,,	● New Moon	2 47 a.m.
20 ,,	☾ First Quarter	6 2 a.m.
27 ,,	○ Full Moon	3 15 a.m.

Apogee, 7th January, at 1.0 a.m.
Perigee, 22nd January, at 1.0 p.m.

On the 14th Mercury will be in inferior conjunction with the Sun (in a line between the Earth and Sun) and on that occasion at a distance of more than 55,000,000 miles from the Earth.

On the 14th also Uranus will become stationary, which can never be an interesting phenomenon to the ordinary observer, since Uranus can only on rare occasions be seen without good optical aid by those with excellent eyesight; moreover, it is among very small stars in the south-west corner of Leo.

On the 17th Venus will be 6 deg. south of the Moon at 1 a.m., and Saturn on the same day 8 deg. south of it at 2 p.m. They will be above the horizon within 3 hours after sunset.

Venus, which since the middle of November has passed through the whole of Capricornus into Aquarius, will there on 24th January meet the distant and slowly moving Saturn, which has been in that constellation since January last. It will be seen as a fairly close conjunction after sunset, since they will be separated by about 2 deg. at moontime.

The Southern Cross, which was absent from the evening sky at Christmas time, will come into view at Warwick about 9 p.m. and at Brisbane not until 11 p.m., low down in the S.S.E. at the beginning of January.

Mercury rises at 6.27 a.m., 1 hour 27 minutes after the Sun, and sets at 8.9 p.m., 1 hour 19 minutes after it, on the 1st; on the 15th it rises at 5.15 a.m., 4 minutes after the Sun, and sets at 6.43 p.m., 8 minutes before it.

Venus rises at 8.21 a.m., 3 hours 21 minutes after the Sun, and sets at 9.54 p.m., 3 hours 4 minutes after it, on the 1st; on the 15th it rises at 8.41 a.m., 3 hours 30 minutes after the Sun, and sets at 9.27 p.m., 2 hours 36 minutes after it.

Mars rises at 12.30 a.m. and sets at 1.20 p.m. on the 1st; on the 15th it rises at 11.59 p.m. and sets at 12.59 a.m.

Jupiter rises at 4.45 a.m. and sets at 6.35 p.m. on the 1st; on the 15th it rises at 4.6 a.m. and sets at 5.52 p.m.

Saturn rises at 10.8 a.m. and sets at 11.48 p.m. on the 1st; on the 15th it rises at 9.23 a.m. and sets at 9.5 p.m.

3 Feb.	☽ Last Quarter	10 4 p.m.
11 ,,	● New Moon	5 34 p.m.
18 ,,	☾ First Quarter	1 49 p.m.
25 ,,	○ Full Moon	5 43 p.m.

Apogee, 3rd February, at 10 p.m.
Perigee, 16th February, at 6 a.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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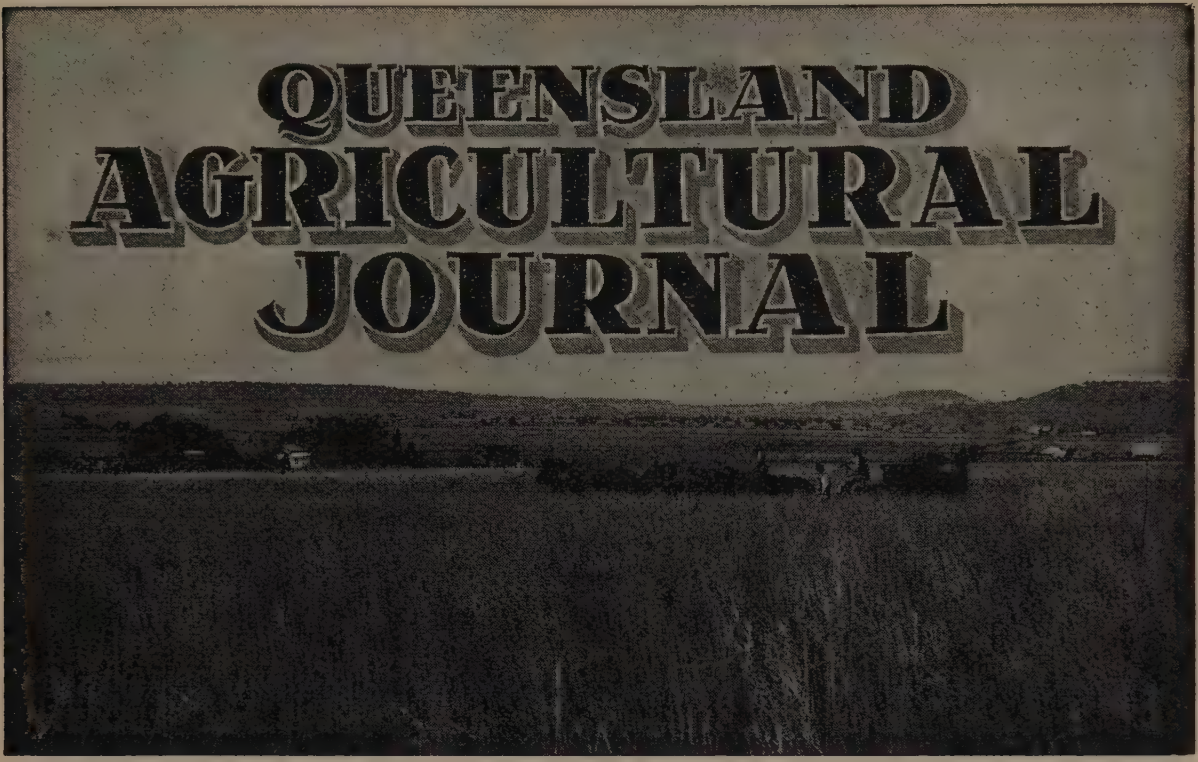

VOL. XLVII. 1 FEBRUARY, 1937. PART 2

Event and Comment

Protection for the Farmer.

IN the course of a recent announcement the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, stated that the question was frequently raised: How do farmers of other countries supplying the British market at parity succeed in remaining solvent while our farmers say that solvency under these conditions is impossible? The reasons were not hard to discover, he remarked. Many of the countries supplying Britain with dairy produce had an exceedingly low standard of livelihood in comparison with that established in the Commonwealth, and it was no exaggeration to say that the production in those countries was frequently the production of people who were little better than serfs.

In addition, tariff policies increased the Australian farmer's cost of production, and if the producer were compelled for national reasons to purchase in a protected market, was it not reasonable to assume that he could not afford to sell in an open market?

Continuing, Mr. Bulcock said that without protection Australia would be a dumping ground for the products of cheap and exploited labour countries, and our industrialists would soon be out of work. The referendum would ask that the same protection should be applied to the farmer as was extended to other and larger sections of the community.

Practically every major agricultural country in the world was organising production and marketing, and Britain attached great importance to this activity. It was said that the House of Commons is now more agriculturally minded than has been the case during the past century; and Canada and the United States of America are associated with orderly marketing, because they, in common with all other countries, realise that the soil is the source of all our wealth. Here in Australia, we, too, are recognising this elementary truth very clearly, and, in addition, are also realising that the producer is a consumer. In order to build up our industries the farmer must have adequate purchasing power. In other words, if he cannot purchase industries languish and unemployment increases. But the farmer cannot purchase if he is singled out for adverse economic treatment.

The Farmer's Purchasing Power.

IF the referendum is carried the farmer's purchasing power will be strengthened, and all sections of the community will therefore benefit. If it be not carried the farmer's purchasing power will wax and wane, in response to overseas price movements, and the first essential of economic progress—stability—will be missing,'' added the Minister. He then proceeded to examine the position in the event of the people of Australia refusing to give the producer stabilisation and a domestic price.

For a brief period they would remain on their present level of production, but slowly and surely uneconomic prices would drive many producers out of agriculture. Then there would be a rise in prices, production would increase to a point, where uneconomic prices again intervened, and production would again decline.

Organised marketing sought to prevent this happening. Nationally it was disastrous, and the consumer over a number of years gained nothing. But we as a people could not afford to yield our fate to uncontrolled economic force, and as development and yet more development was necessary, we must concede to the producer that which was esesntial, not only to his wellbeing but to the security and solvency of the Commonwealth.

Lack of Close Agricultural Organisation.

AGRICULTURE is, generally speaking, the one major activity of mankind which is not satisfactorily organised, said Mr. Bulcock. Industry and labour had entered into national and, in some cases, international alliances for their protection. It was clear that the benefits accruing to an organised section might be paid for by an unorganised section, and it followed that, so long as farming was an unorganised occupation it would be compelled to make a contribution, not only to its own maintenance, but also to the maintenance of other enterprises.

Obviously, that was a condition that should not be perpetuated, but we had heard from time to time of an opposition developing to the proposed referendum. So far as could be seen, the Governments of three States of the Commonwealth favoured the referendum. Within those three States was produced 90 per cent. of the total of Australia's agricultural exports. The other States, representing only 10 per cent. of export production, had it in their power to prevent the farmers' achieving that degree of economic stability which was their due.

Price Movements.

AN interesting phase of that question presented itself if one studied price movements in Queensland and similar movements in the Southern States, Mr. Bulcock continued. It was generally conceded that the farmer in Queensland is far better off than the farmer in any other State of the Commonwealth, the chief reason being that farming in Queensland is organised to the limit of the State's resources.

This, of course, was not the condition in any other State of our Federation, but, strangely enough, the cost of living in Queensland is the lowest of any State in the Commonwealth. It was clear, then, that organised marketing, properly regulated, does not make a levy on the family budget, but does relieve the taxpayers in the final analysis of maintaining people who are engaged in an industry made unremunerative by an adverse economic structure.

In these days, when it is popular to talk about tax reductions, it is well to look at the volume of assistance that the taxpayers of Australia have given the primary producer. Bounties in many directions are becoming established axioms of our agricultural life, and I know of no more inadequate way of permanently assisting farming than to levy the taxpayer to provide a bounty to buoy up an industry that can only be solvent when organised. Organised marketing very reasonably can mean a reduction in the sum total of taxation levied by the Commonwealth.

Babel or Pentecost?

CONCLUDING, Mr. Bulcock expressed the opinion that the farmers of Queensland would, without doubt or hesitation, vote for the referendum. ''I am convinced,'' he said, ''that the consumer will not inflict any restriction on his purchasing power by supporting it. Where, then, does the opposition arise? A study of the organised marketing movement in Queensland will show that, as this type of organisation was achieved, it met with the hostility of certain interests who, until the advent of organised marketing, had been successful in intercepting the commodity as between the producer and the consumer, and levying tribute upon it, which was paid, of course, by the consumer and producer.

''Commonwealth marketing would mean in many instances that this intermediate levy would not be possible of collection by interested parties, and consequently the matters associated with this referendum cannot be expected to receive the blessing of the individual who prefers to farm the farmer rather than farm the land.

''In conclusion, I would say that there are three unassailable reasons why this referendum should be supported:—

(1) Because it has a basis of natural justice;

(2) Because Australian solvency depends on the organisation of our primary production.

(3) Because the future of Australia is so intimately wrapped up with our agriculture that everything possible must be done in order to conserve and expand primary undertakings.''

Citrus Diseases.

J. H. SIMMONDS, M.Sc., Senior Plant Pathologist.

THE extent to which citrus is affected by disease in Queensland varies greatly with the location in which it is grown. In the drier inland districts, with the exception of certain physiological troubles such as mottle leaf, disease is not an important factor. On the coast, however, where warm moist conditions normally prevail during spring and summer the presence of diseases, especially those affecting the fruit, makes it difficult to produce citrus of satisfactory appearance and quality. When spraying is necessary, Bordeaux mixture has been found efficacious. However, this spray possesses the disadvantage that its continued application has a detrimental effect on citrus trees as well as promoting an increased scale insect infestation. For this reason it has been the practice to add 1 per cent. of emulsified red oil to the Bordeaux. In addition to acting as a spreader the oil is believed to check scale development to some extent and so minimise the ill effects of the Bordeaux in this respect. However, if more than one application of Bordeaux is made it is usually necessary to take special precautions later in the season for the control of the scale. For this purpose the resin-soda-fish oil spray is recommended, the use of which is described in Bulletin No. 10, "Queensland Scale Insects and their Control." Recent experiments indicate that colloidal copper may prove a useful substitute for Bordeaux mixture on citrus since it is an effective fungicide and yet does not tend to increase scale infestation to nearly the same extent. In those districts where scale insects are a serious problem it is recommended that a trial be made of this spray.

The control of some Queensland citrus diseases is still under investigation, and in these cases it has been possible to make only preliminary recommendations.

BLACK SPOT.

Black spot is probably the most common and destructive disease of citrus in Queensland. Most commercial varieties are subject to its attack.

The disease is almost entirely restricted to the fruit, and does not usually appear before the latter is colouring or approaching maturity. Minute reddish-brown spots appear scattered over the surface of the rind on the side exposed to the sun. These develop into circular areas one-sixteenth to one-eighth of an inch in diameter, and the central portion becomes shallowly depressed and may assume a greyish colour. On fruit which has fallen or which has been stored for some time, a brown and somewhat shrunken area may extend out from the initial spots and cause serious blemishes. (Plate 41, figs. A and B.) Black spot is much more prevalent on exposed fruit on the sunny side of the tree. Affected fruit will not hang on the tree when ripe, and loss is occasioned by the fruit falling off before picking as well as by the actual disfigurement.

Black spot is caused by a fungus (*Phoma citricarpa*). Unlike the organisms causing most other diseases of citrus, this fungus is restricted to Australia and some Eastern countries. The spores which spread the disease are contained in small flask-shaped receptacles imbedded in the rind. These may be seen as minute black points studding the centre of the spots.

Control.

(1) As with other citrus diseases, the incidence of black spot can, to a certain extent, be lessened by keeping the trees in a healthy, vigorous condition by satisfactory manuring and cultivation. Dead and sickly wood should be pruned out.

(2) Fallen fruit should be picked up and destroyed by fire or burying.

(3) Experiments have shown that black spot may be controlled by spraying with Bordeaux mixture. This work is not yet completed, but until further results are available the following schedule can be recommended.

It should be realised that most of the infection takes place when the fruit are very young and probably little or none later than six months after setting, although the actual spotting does not appear until the fruit are approaching maturity and changing colour.

Spray with Bordeaux mixture (3-2-40), to which 1 per cent. (approximately $\frac{1}{2}$ gallon to 40 gallons) red oil well emulsified in its own volume of water has been added as a spreader at the following times:—

(1) When the greater part of the blossom has fallen (i.e., more than 75 per cent.);

(2) About two months later in December.

If infestation by scale becomes too heavy, special precautions will have to be taken for their destruction as recommended in the introduction. Growers are advised to try the substitution of colloidal copper for the Bordeaux mixture.

MELANOSE.

Melanose is a trouble which is to be found most frequently in old or neglected orchards. Leaves, twigs, and fruit are all affected, though it is on the last that the disease is most conspicuous. Here the lesions consist of small brown specks or dots rarely exceeding one-fiftieth of an inch in diameter, which are scattered sparsely or abundantly over the surface of the rind. (Plate 41, fig. D.) These appear at first as a surface stain only, but later they become slightly elevated and somewhat fissured diagonally or round the margin, so that a melanose-affected fruit is decidedly rough to the touch. Examined microscopically, the lesions are seen to consist of two or three layers of brown, gum-filled cells which, in later stages, become elevated by the development of corky tissue beneath. The spotting in the leaves and twigs resembles in general appearance that on the fruit, except that it is black rather than brown in colour.

When the spots are so numerous as to coalesce, melanose is sometimes mistaken for maori or exanthema. The brown discolouration of the typical maori orange, however, is not broken up into distinct spots and is quite smooth to the touch. On a fruit affected with exanthema the spots are less uniform in size. There is a tendency for the formation of a blotchy condition rather than distinct spots, and the skin is more definitely hardened.

It is a fungus (*Phomopsis citri*) which is responsible for melanose. This organism, however, does not develop on the living part of the tree, but on dead twigs. Here it forms its spores, which become washed down over the young fruit and foliage. If wet weather occurs when the tree is in the susceptible stage, these spores will germinate and affect the young growing tissue just sufficiently to cause the spotting described above.

The dependence of the melanose fungus on the presence of dead wood for its existence explains why it is the older or neglected orchards that suffer most from this disease. It is only young shoots and fruit which are susceptible to infection. As the growth hardens off it becomes progressively more resistant. Hence, in any spraying programme, it is necessary to provide for protection at the critical period.

Control.

(1) So far as is practicable, remove all dead twigs and branches. Practise a system of fertilizing and good cultivation, with a view to promoting strong, healthy growth.

(2) Immediately all the petals have fallen, spray with Bordeaux mixture of 3-2-40 strength, to which has been added 1 per cent. of well-emulsified red oil, to act as a spreader and help keep scale insects in check.

If it is desired that this spray should also act as a control for scab—as, for example, when lemons or mandarins are to be treated—the spray may be applied as early as half petal fall, but it should never be later than the time given above.

SCAB.

Only lemons and mandarins are subject to this disease, the young leaves, shoots, and fruit being affected as in the case of melanose. The scabs are quite characteristic of the disease, and consist of irregular, light-brown, corky outgrowths. These may be no larger than melanose spots, or may be distinctly wart-like projections. On the leaf there is often a small conical depression of the blade bearing a mass of cork tissue at its apex. Considerable distortion and stunting of the leaf may occur if the scabs are numerous. On the fruit, especially of the lemon, large scab-covered projections may be formed by an outgrowth of the surrounding rind tissue. (Plate 41, fig. E.)

Scab is due to the presence of a fungus (*Sporotrichum citri*), whose fruiting stage appears as a delicate greyish mould covering the surface of young scabs. As in the case of melanose, the fungus can infect only young growth. Rain at the time of a new flush of growth is essential for scab development.

Control.

Spray with Bordeaux mixture, 3-2-40 strength, plus 1 per cent. of well-emulsified red oil, at the middle of the spring flowering period —that is, when about half the petals have fallen.

It is important that this application should be made at the time stated and not delayed until later. The lemon normally has more than the one fruiting period, and, consequently, it may be advisable to spray again at a similar time with respect to other main blossomings.

The remarks made previously with reference to scale infestation apply to a certain extent to melanose and scab control also.

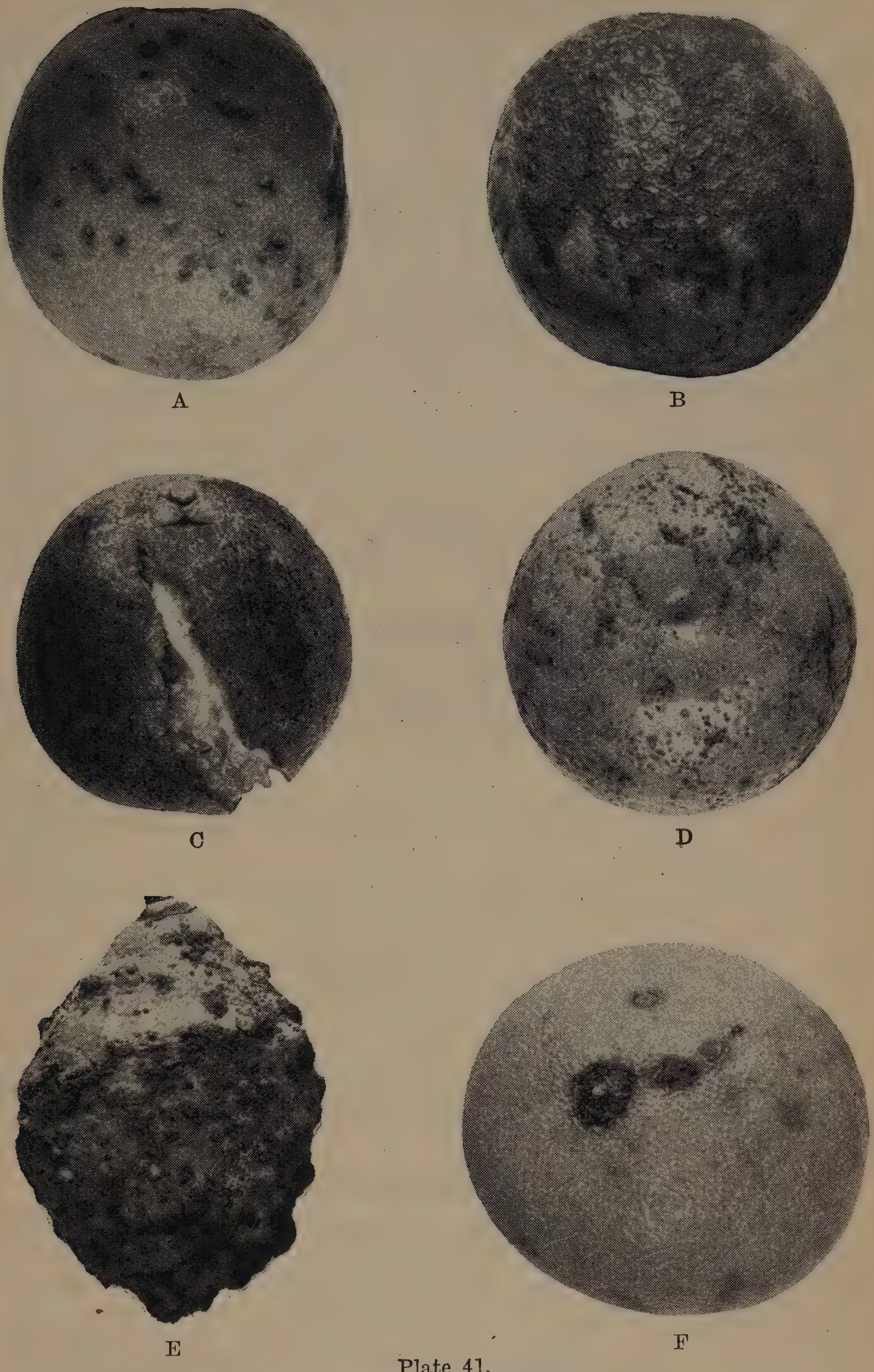

Plate 41.

Citrus Fruit Diseases.

A. Black spot on orange.
C. Exanthema on orange.
E. Scab on lemon.

B. Later stage of black spot infection.
D. Melanose on orange.
F. Brown spot on Emperor mandarin.

BROWN SPOT OF THE EMPEROR MANDARIN.

This is one of the most serious citrus diseases of this State, though, fortunately, the Emperor of Canton mandarin is apparently the only commercial citrus variety which is susceptible, and the disease is not widely distributed. Every care needs to be taken to ensure that there is no spread to fresh centres.

The symptoms take the form of dark-brown spots on the leaves, fruit, and younger branches. These can be distinguished from the lesions of black spot, in that they are larger and are a uniform brown colour without a lighter centre; also, the fungus pustules characteristic of the latter disease are absent. (Plate 41, fig. F.) On the leaf the browning may extend out along the veins to give a characteristic streaking. On the branches small cankers may develop from the original centres of infection as the wood matures. Small beads of gum exudate are often associated with these. Affected leaves and fruit drop readily when once attacked, and it is in this way that most loss is sustained. The falling of the younger leaves is often accompanied by a dieback of the young shoot, which is then spotted and blackened in appearance. The spots may appear on young tissue of fruit and foliage as soon as they are developed should other conditions be favourable. The cause of this disease is still unknown.

Control.

For the past four years experiments have been carried out to determine the best spraying programme to control brown spot, and although the work is still in progress the following can be recommended:—

(1) When about half the blossom has fallen spray with Bordeaux mixture (3-2-40), with 1 per cent. well-emulsified red oil as a spreader.

(2) About four weeks later spray with colloidal copper (3 gallons stock solution to 40 gallons water).

(3) During mid-December spray again with colloidal copper.

(4) During late February spray again with colloidal copper.

As in the case of black spot control, an application of resin-soda-fish oil spray may be used to overcome any excess scale development, in which case it should be made as late as practicable. Growers may try substituting colloidal copper for the Bordeaux in the above schedule.

BLUE MOULD.

Blue-mould rot of citrus fruits is caused by one of two allied fungi —*Penicillium digitatum*, which forms a powdery spore mass, olive-green in colour, on the surface of the rotting fruit, and *Penicillium italicum*, considerably less common, in which the spores are blue.

The rot commences as a soft, water-soaked spot on the rind almost invariably associated with some form of injury, slight or otherwise. As the softening extends, the surface of the affected area soon becomes coloured with the blue or green covering of spores, which are dislodged in a cloud when touched. Finally, the fruit is reduced to a soft, watery mass.

Most of the loss occasioned by blue mould occurs when sweating or during transport. The reason for this development has been investigated in various countries for many years. The conclusions arrived at should be carefully studied, as they have an important bearing on control. They are as follows:—

(1) The blue-mould fungi are relatively weak parasites, and are unable, as a general rule, to penetrate perfectly sound fruit.

(2) The wounds occasioned during picking, carting, and packing serve as the centres of infection for the blue-mould spores, which are always present in the air of the packing-house unless strict sanitation is practised. Common forms of injury are case bruises and cracks, stalk punctures, scratches from the finger-nail or other agencies. Insect damage, growth cracks, thorn pricks, and other injuries occurring in the orchard may sometimes result in fruit becoming infected while still on the tree.

(3) Loss can, to a large extent, be overcome by cleanliness and careful handling of the fruit.

Control.

Keeping the above facts in view, the value of the following recommendations should be obvious:—

(1) Collect at frequent intervals all waste fruit in the orchard and packing-house and destroy by burning or burying.

(2) Take care that no injuries are given by the clippers or finger-nails during picking. Fruit should be cut, not pulled. Long stalks must be avoided, and a second cut made if necessary, while the fruit is still in the hand. Avoid picking during wet weather or when dew is present.

(3) Collecting boxes must be smooth and the fruit placed in them carefully. Packing-cases should be of smooth wood. Careful and accurate packing is essential to avoid bruising and cracking, especially in the case of mandarins. Wrapping the fruit is helpful in reducing case-bruising and in localising the centres of infection.

(4) Citrus fruit is best allowed to cure for three to seven days before packing. During this period and when grading, all rotting and blemished fruit should be discarded.

(5) Passing the fruit through a wash water containing 5 to 7 per cent. borax and other disinfectants helps to minimise the loss, but it is generally conceded that cleanliness and careful handling are of first importance, and except in certain exceptional cases are all that is required.

BROWN ROT AND STEM END ROT.

Brown rot caused by either of the two fungi *Phytophthora citrophthora* or *P. parasitica* and stem end rot due to two other organisms (*Phomopsis citri* or *Diplodia natalensis*) appear at sporadic intervals in Queensland, when they are mainly responsible for storage losses. In the northern part of the State brown rot caused by the first-mentioned organism has resulted in heavy loss of fruit and foliage in the orchard. These diseases are characterised by a dull brown rot extending over large areas of the skin. The rot is usually firmer than in the case of blue mould and the blue spore mass characteristic of the latter is absent. In the case of stem end rot the brown decay usually extends down from the button both externally and through the centre.

So far diseases of this type have not been sufficiently prevalent to warrant the investigation of special control measures. In the case of brown rot it is advisable to spray with Bordeaux mixture prior to the period when the disease is expected. For the stem end rots the precautions recommended for melanose control should be taken. It will be noticed that the fungus *P. citri* is also the cause of the latter disease, and *D. natalensis* has somewhat similar habits.

COBWEB OR PINK DISEASE.

Pink disease is found in the more tropical citrus-growing countries, and in Queensland is most common in the warm, wet, coastal belts, especially in the North. Many other crops, including rubber, coffee, tea, and mango, may also be attacked.

The presence of the disease is usually first indicated by the wilting of one or more small branches. A closer examination will usually show that there is a silvery growth of cobweb-like threads extending over the bark of the affected branch near where it joins healthy wood. (Plate 42, fig. C.) This cobweb growth belongs to the fungus *Corticium salmonicolor*. Some of the threads penetrate the bark and wood, and so cause the wilting and death of the branch as first observed. If not checked the fungus will extend down the branches, involving the destruction of larger limbs in its path.

During wet weather the fungus may develop a conspicuous salmon-pink encrustation over the lower, shaded and damp sides of the dead branches. This is the spore-bearing region, and is responsible for the common name of pink disease.

Control.

The essential factor in controlling this disease is not to delay treatment. Examine carefully any wilting or dead branch, and ascertain whether cobweb disease or an insect borer is present. If the former, remove the branch at least eighteen inches below the last point at which the fungus or discoloured bark can be seen. Burn the affected wood and paint the cut end of the branch for another eighteen inches back with Bordeaux paste or tar.

Examine the tree later to make sure that eradication has been complete, otherwise the process will have to be repeated.

PSOROSIS.

Psorosis was first recorded in Queensland in 1927, and has since been located in most of the citrus-growing districts. As the disease is slow to develop, there should be no difficulty in keeping it in check, provided that it always receives prompt and thorough treatment.

Psorosis is found on the main limbs and branches of trees six or more years old. The sweet orange, the mandarin and the grape fruit are susceptible, whereas the sour orange and the lemon are resistant.

The earliest symptoms are the appearance in localised areas of inconspicuous pimples or blisters and the formation of scales by the pushing up of small segments of the outer bark. Some gum formation is often associated with this. The flaking off of the bark extends out slowly, and after several years the wood beneath becomes affected and decays, with the result that the limb may be lost. (Plate 42, fig. B.)

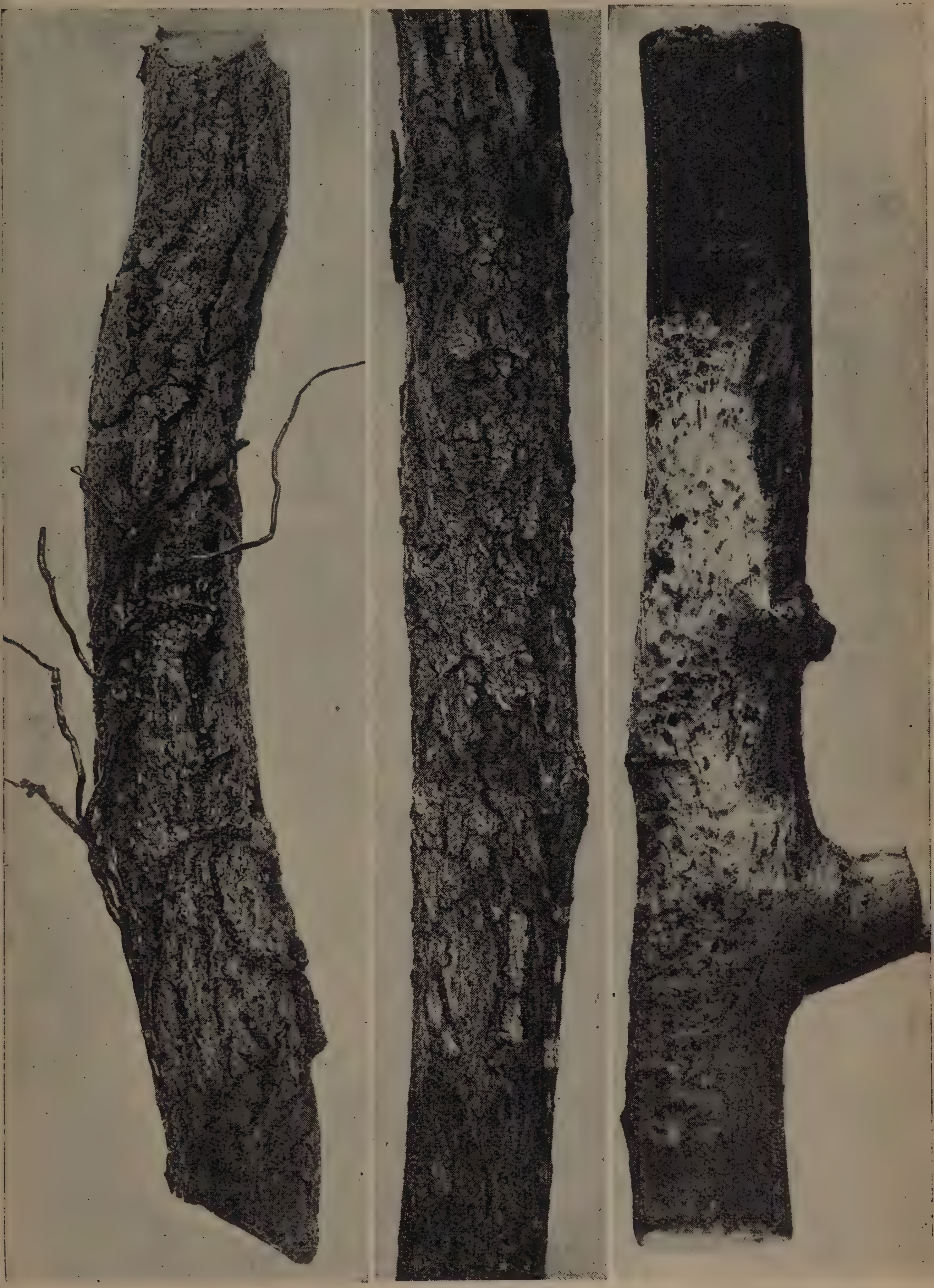

Plate 42.

A—*Armillaria mellea* on orange root.

B—Citrus psorosis.

C—The cobweb stage of pink disease.

The cause of psorosis is not definitely known, though it is now thought that it may belong to the class of virus diseases and not be due to any fungus or bacterium. A satisfactory control is, however, available if treatment is commenced in the early stages.

When a localised area of scaling or pustular bark is observed treat it in the following manner:—By means of a tool with a sharp scraping edge carefully scrape off the outer bark over the affected area and for about six inches all round outside it. The scraping should take off the dark-coloured outer tissue and the green layer immediately beneath it, so that about one-third of the thickness of the bark is removed. The scraped area can then be treated with a one-in-six (approximately 3 per cent. polysulphide content) lime-sulphur solution.

Within three to six months after treatment the outer layers should slough off and expose new and healthy bark. All trees should be examined at intervals for the extension of old lesions or the development of new ones and be promptly treated if necessary.

When the lesions on a tree are large or numerous it is likely that the disease has become systemic, and scraping cannot then be expected to effect a complete cure. In this case it is best to remove and burn the affected tree.

EXANTHEMA.

In pronounced cases exanthema shows up with a flush of new growth, the branches of which are sometimes curved at the ends and bear abnormally large dark-green leaves. Later a dark-brown deposit of a resinous material appears along the twigs, and the shoots gradually turn yellow and die back. Blister-like gum pockets, multiple buds, and very angular stems are other characteristics associated. In less definite cases there may be a multiplication of the terminal branchlets and a shortening of the internodes to give a bunched appearance to the tree as a whole. The crop from a diseased tree is usually poor, as a result of the fruit dropping while immature, and from the development of dark-brown superficial spots or blotches accompanied by a hardening of the skin, which often leads to cracking. (Plate 41, fig. C.)

Exanthema is apparently not dependent on the presence of parasitic organisms for its development. The exact cause remains undetermined, although recent work suggests that it may be due to an insufficient supply of copper to meet the normal needs of the tree. In Queensland the disease is usually associated with very light, sandy soils lacking in humus. It is aggravated by poor drainage and hard pan.

Control.

Remove all dead and dying wood. Improve the soil conditions by manuring, with a bulky farmyard manure if procurable, and by ploughing in green crops. Drain the land if necessary. A relatively quick cure may often be obtained by the application of bluestone (copper sulphate). This may take the form of a Bordeaux spray, for which the normal melanose and scab spray applied at blossoming time is suitable, or the bluestone crystals may be chipped in round the tree, using from 1 to 2 lb. per tree, depending on size. Results should become obvious twelve months from the date of application.

MOTTLE LEAF OR FOLIOCELLOSIS.

As the name suggests, this disease is characterised by a mottled condition of the foliage. This is due to the development of irregular, yellow, chlorotic areas between the main veins of the leaf. These areas vary greatly in size and in some cases the normal green colour is entirely absent except in the immediate vicinity of the large veins. According to the severity of the disease the foliage may be otherwise normal or there may be a marked stunting in growth with the formation of a small narrow type of leaf. The fruit produced on branches affected in the latter manner are often greatly reduced in size and tend to yellow prematurely.

There is still doubt as to the exact cause of mottle leaf. It is apparently, like exanthema, a physiological disease brought about by a disturbance in the normal nutrition of the tree. Recent work on mottle leaf and on an allied disease of deciduous fruits suggests that it may be due to a shortage in the amount of zinc available to the plant. This is probably connected with the intimate relationships existing between the smaller citrus roots and certain microorganisms of the soil. In Queensland the disease is most serious in the light sandy soils of the drier inland districts.

The control of mottle leaf is still in an experimental stage, the subject being under investigation both here and abroad. Best results have so far been obtained by applying zinc sulphate either as a soil dressing or a spray or by a direct injection of zinc or zinc compounds into the branches. Owing to the present lack of knowledge, and a danger of injury to the treated trees, the spray method is the only one which can be suggested for trial at present. A spray consisting of 10 lb. zinc sulphate, 5 lb. hydrated lime, in 100 gallons water should be applied in the early spring and again, if the disease is severe, in the autumn.

The production of an extensive and efficient root system by correct manuring, especially with bulky organic manures, and whenever possible by irrigation in dry periods, is an important adjunct to the above treatment.

COLLAR ROT AND GUMMING.

The lemon or lemon stock, especially in coastal districts, is particularly subject to collar rot and gumming, as are, to a less extent, the mandarin and sweet orange. The first indication of the presence of this disease is a yellowing or unhealthy appearance of a section of the foliage accompanied, perhaps, by excessive flower formation. Examination of the base of the trunk or one of the main branches discloses a dark, water-soaked area, from which gum drops are often exuding. The bark over this region can be readily lifted, and between it and the wood is a slimy, gum-like substance. Extension of this lesion will gradually ringbark the trunk or branch affected. Less frequently the lemon may develop gumming areas even on the smaller branches.

To lessen the risk of infection the soil should be kept well pulled away from the base of the tree, and care should be taken to avoid injury during cultivation. If noticed before it has advanced too far, the disease may be cured by surgical methods. If the crown and main roots are affected, open them up to the sun and air. Carefully remove the whole of the diseased bark and wood by cutting or scraping well back into sound tissue with a sharp instrument. Collect and burn the scrapings. Paint the wound with Bordeaux paste.

If a lemon is neglected until most of the limbs are affected it may be necessary to consider replanting. When soil or locality are unsuitable this state usually eventuates after some years.

When collar rot is the result of the use of a susceptible stock, inarching with one less susceptible may be considered worth while.

ARMILLARIA ROOT ROT.

The tree affected by this disease exhibits symptoms similar to those associated with collar rot. That is to say, there is a yellowing of the foliage of the whole tree, or one of its branches, together with some dieback. If, on examination, no gumming is found, the larger roots should be opened up and examined. If Armillaria root rot is present, shiny, black, string-like, fungal strands will be seen twining themselves about the roots or lying partly embedded in the bark, which is soft, easily stripped off, and has a strong mushroom odour. (Plate 42, fig. A.) The black strands belong to one of the mushroom-like fungi (*Armillaria mellea*), which grows on rotting stumps or roots left in the ground after clearing, and from these passes to a living citrus root should one come in contact.

The disease may be largely prevented by having all stumps and roots removed from land which is to be used for orchard purposes, and, if time is not a factor, by growing an annual crop for a year or more prior to planting trees.

Expose the main roots to the beneficial action of sun and air for as long as the absence of frosts will permit. Remove any badly-rotted roots and treat those partly affected by carefully scraping and painting, as advised for collar rot.

Remove and burn the original stump or root from which infection started if this can be located.

The affected area is best isolated to prevent further spread of the fungus to healthy trees by digging a trench two feet deep round the outside of the furthest root extension of the ones attacked, throwing the soil to the inside.

SOOTY MOULD.

Sooty mould is a conspicuous, though in itself relatively unimportant, disease of citrus. The black, sooty deposit covering the foliage and often the fruit of affected trees is well known to most citrus-growers. An examination of the leaves will show the sooty appearance to be due to a thin, black, superficial film, which may be easily scraped off in flakes. This film is formed by the close interlacing of the dark threads of various fungi, of which the chief are species of *Capnodium*. These fungi are not plant parasites, but live on the sugary secretion of certain scale insects, of which the more important ones concerned are the pink and white wax scales and the lecanium or soft scales.

The fungus is entirely superficial in its growth, and does not directly injure the tree, although the presence of the film of mould may tend to weaken it by the exclusion of light and air.

Control.

To rid a tree of sooty mould, it is necessary to destroy the scale insects, on whose secretion the fungus is dependent for its existence. Specimens of the scale insects present should be forwarded to the nearest entomologist in order that advice may be obtained on the best method for their control. If it is desired to remove the mould quickly after destroying the scale, spray the tree with a thin paste made by boiling flour in water. When this dries it will flake off, carrying away the mould in the process.

SMOKY BLOTCH.

Smoky blotch is the name given to a disease which has become prevalent in coastal citrus orchards during recent years. A diffuse smoky discolouration on the skin gives a dull, dirty appearance to the fruit as it approaches maturity. In contrast to sooty mould this discolouration is light-brown rather than black and consists of a very thin surface film which can be rubbed off only with difficulty. It is formed by the fine interlacing threads of the fungus *Leptothyrium sp.* Local aggregations of these threads to form resting and fruiting bodies may produce scattered black specks over the rind. This has given rise to the name of fly speck in some countries, but it is a stage not commonly in evidence here.

The application of fungicides for the control of other citrus diseases should check smoky blotch as well. The resin-soda-fish oil spray is also reported to exercise some control.

QUEENSLAND SHOW DATES FOR 1937.

February.

Pittsworth's Bushmen's Carnival	1st
Stanthorpe	3rd to 5th
Warwick	8th to 10th
Killarney	12th and 13th
Clifton	23rd and 24th

March.

Allora	3rd and 4th
Amiens	6th
Goombungee	11th
Milmerran	19th
Pittsworth	23rd and 24th
Tara Show and Campdraft	24th and 25th
Boonah Campdraft	29th

April.

Oakey	7th and 8th
Toowoomba Royal	12th to 15th
Dalby	21st and 22nd

May.

Longreach	3rd to 6th
Beaudesert—	
Show	5th and 6th
Bushmen's Carnival	7th and 8th
Wallumbilla	6th and 7th
Nanango	6th and 7th
Dirranbandi	6th to 8th
Ipswich	11th to 14th
Wowan—	
Show	13th and 14th
Rodeo	15th
Crow's Nest	12th and 13th
Biggenden	20th and 21st
Gympie	20th to 22nd
Warrill View	22nd
Kilkivan	24th and 25th
Maryborough	25th to 27th
Charleville	25th to 27th

May—continued.

Maryborough	25th to 27th
Gin Gin	28th and 29th
Toogoolawah	28th and 29th
Kalbar	29th
Childers	31st May and 1st June

June.

Bundaberg	3rd to 5th
Lowood	4th and 5th
Boonah	9th and 10th
Gladstone	9th and 10th
Rockhampton	22nd to 26th
Marburg	18th and 19th
Mackay	28th June to 1st July

July.

Bowen	7th and 8th
Ayr	9th and 10th
Rosewood	9th and 10th
Cleveland	9th and 10th
Townsville	13th to 15th
Nambour—	
Show	15th and 16th
Campdraft	17th
Esk	16th and 17th
Charters Towers	20th and 21st
Laidley	21st and 22nd
Cairns	27th and 28th
Gatton	28th and 29th
Caboolture	30th and 31st
Maleny	22nd and 23rd

August.

Royal National, Brisbane	16th to 21st

September.

Imbil	3rd and 4th
Rocklea	11th
Innisfail	17th and 18th

Principles of Botany for Queensland Farmers.

C. T. WHITE, Government Botanist.

[*Continued from page* 48, *January*, 1937.]

CHAPTER XXIV.

Dicotyledons.

Subclass Metachlamydeæ or Sympetalæ.—Perianth in two whorls or series, the inner (corolla) is gamopetalous and the stamens are often epipetalous, i.e., attached to the corolla and appearing as outgrowths from it.

FAMILY SAPOTACEÆ.

A family of trees often with a milky juice. Leaves simple, alternate. Flowers usually hermaphrodite, borne in the leaf-axils or on the older wood below the leaves, sometimes solitary, usually clustered. Calyx of 4-8 segments or sepals. Corolla divided into lobes or teeth, which may be the same number as or double the number of sepals. Stamens the same number as the petals or twice as many, often, in addition alternating with staminodia and scales. Ovary superior. Fruit a berry or drupe.

The family is widely distributed over the tropics and sub-tropics of the world. About twenty species are natives of Queensland. These include two known as Milky Plum (*Niemeyera*) and the Black Apple (*Sideroxylon australe*), Cairns Pencil Cedar (*Lucuma galactoxyla*), and the Wongi (*Mimusops Browniana*), the last an important native fruit to the natives of Torres Strait.

A cultivated fruit sometimes seen in Queensland is the Sapodilla (*Achras Zapota* or *Sapota*), a native of Tropical America. It is also the chief source of the chicle gum from which chewing gum is manufactured. Other fruits belonging to this family but which I have not seen here are the Mammee Apple (*Calocarpum mammosum*) and the Star Apple (*Chrysophyllum cainito*), both natives of tropical America.

FAMILY EBENACEÆ.

A family of trees closely allied to Sapotaceæ, but with a watery, not milky, sap, and the flowers mostly unisexual, not hermaphrodite. Leaves simple, alternate. Flowers axillary, the males in cymes or clusters, the females usually solitary. Stamens 8-20 in the males, fewer and sterile in the females. Ovary superior. Fruit a berry.

The family is a small one widely spread over the tropical and sub-tropical regions of the world. It is represented in Queensland by about fifteen species, mostly small or medium-sized trees. The wood of trees of the *Ebenaceæ* is often hard and black, as in the commercial Ebonies, *Diospyros Ebenum* and *D. melanoxylon*, of India. The Queensland Ebony (*Diospyros humilis* or *Maba humilis*) possesses a wood equal in quality to the imported ebonies, and can be used for billiard cue inlay, piano keys, chess men, and general turnery.

The family includes a few cultivated fruits, the most important being the Persimmon (*Diospyros Kaki*), a native of China and Japan. Another is the Mabolo (*Diospyros discolor*), a native of the Philippines, sometimes seen in cultivation in North Queensland; it possesses a brownish, hairy outer rind and a white or brownish pulp.

Family Oleaceæ (Olive Family).

A family of trees or shrubs or woody climbers chiefly characterised by simple, opposite leaves, and flowers with only two (very rarely

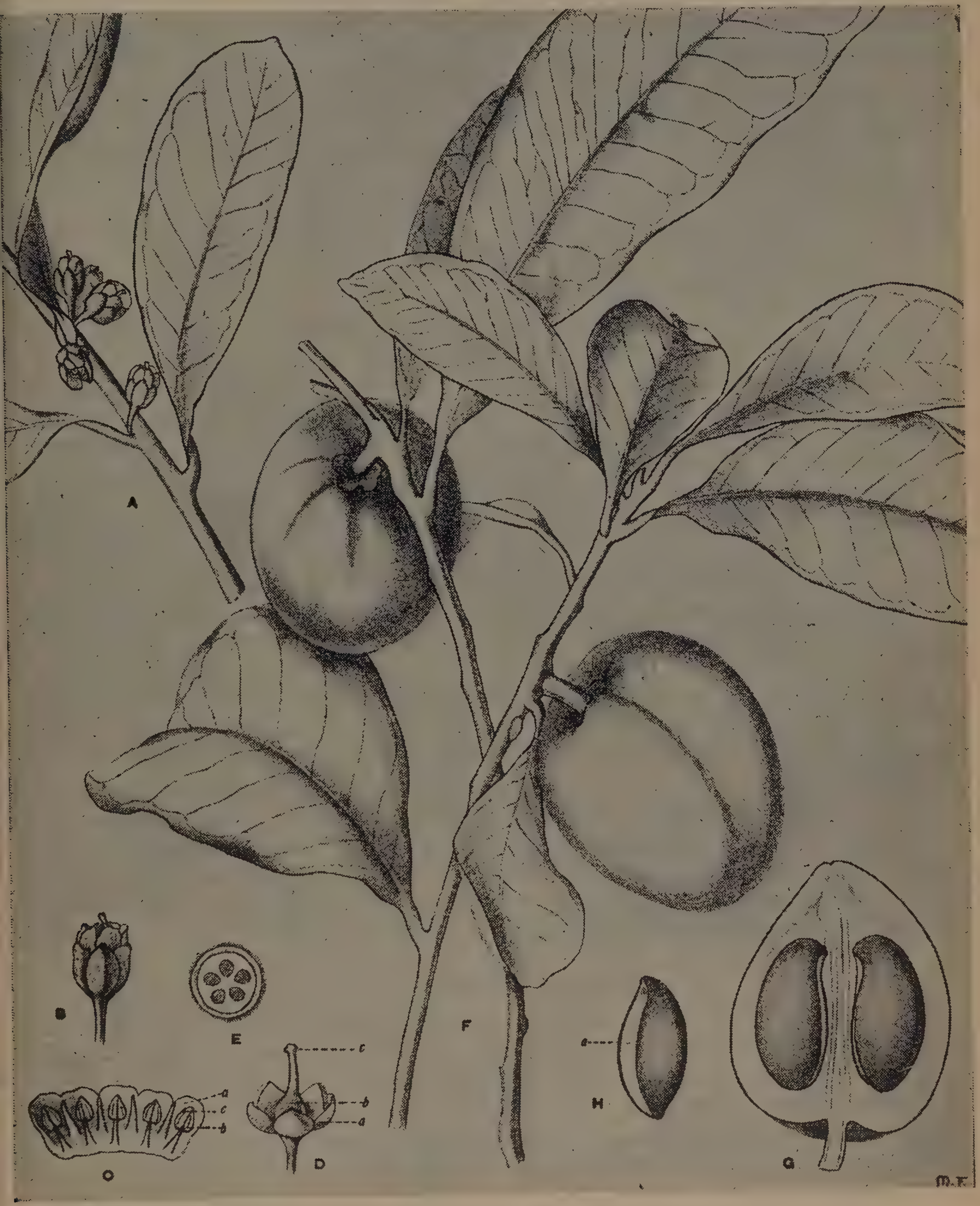

Plate 43.

Black Apple (*Sideroxylon australe*)—Family Sapotaceæ.

A. Flowering twig. B. A single flower. C. Corolla and stamens laid open—*a.* Corolla lobe; *b.* stamen; *c.* staminode. F. Fruiting branches. G. Fruit in longitudinal section. H. Seed; *a.* Hilum.

four) stamens. Flowers mostly in panicles. Calyx composed of 4-5 sepals, teeth, or lobes. Corolla with 4 to sometimes numerous lobes. Ovary superior. Fruit mostly a drupe.

A family widely spread over the world. It is represented in Queensland by eighteen native species, none of any particular economic importance. Among cultivated trees the most important is the Olive (*Olea europæa*). Several Jasmines (genus *Jasminum*) are grown in Queensland gardens.

FAMILY LABIATEÆ (THE LABIATES).

A family of herbs or shrubs, usually aromatic, branches mostly more or less 4-angled. Leaves opposite or whorled. Flowers in cymes, the cymes arranged in whorls in the leaf-axils. Calyx 5-toothed or 2-lipped. Corolla with a distinct tube and the limb divided into an upper and lower "lip," rarely the limb more or less regular and 5-lobed. Stamens 2 or 4. Ovary 4-lobed. Fruit enclosed in the calyx and composed of 4 small, seed-like nuts.

A large family finding its greatest development in the temperate regions of the world. It is well represented in the Queensland Flora by about forty-five native species and several naturalised weeds. Two of these latter, the Stagger Weed (*Stachys arvensis*) and Dead-nettle (*Lamium amplexicaule*) are known to cause staggers or shivers in working stock or stock that have been driven or excited. Ordinary resting paddock stock such as dairy cattle seem to eat the plants with impunity. Strange to say, in Europe and North America, where these plants are common farm weeds, no trouble seems to be experienced from them. A comparatively recent introduction that has caused some concern on account of its difficulty of eradication and poisonous properties is the Wild Mint (*Salvia reflexa*), a native of the Western United States naturalised in Queensland. The name "Wild Mint" is also applied to *Stachys arvensis*, and a good deal of confusion exists between the two weeds. The native Pennyroyal (*Mentha satureioides*) and the naturalised Wild Salvia (*Salvia coccinea*) are reported to cause abortion in cattle.

The family includes a number of culinary herbs as—Sage (*Salvia officinalis*), Marjoram (*Origanum Marjorana*), Thyme (*Thymus vulgaris*), &c. Garden Mint or Spear Mint is *Mentha viridis*, peppermint is *Mentha piperita*, and Bergamot Mint *Mentha citrata*. This last is frequently grown in Australia under the name of Eau-de-Cologne Plant.

FAMILY SOLANACEÆ.

A family of herbs, shrubs, climbers, or soft-wooded trees. Leaves alternate, simple (often deeply lobed and divided, but not truly compound). Flowers solitary or in cymes or 1-sided racemes. Calyx with 4-10 sepals, or toothed or lobed. Corolla 5- (rarely 4-) toothed or lobed. Stamens the same number as the corolla lobes and alternate with them. Ovary superior. Fruit a berry or capsule.

A large family widely spread over both the temperate and tropical regions of the world. It is represented among native plants by almost sixty species, the vast majority of which belong to the genus *Solanum*. Among native plants members of the genus *Duboisia* attain tree size. *D. myoporoides*, the Poisonous Corkwood, is a small soft-wooded tree. The leaves are very poisonous, and cases are on record of children being

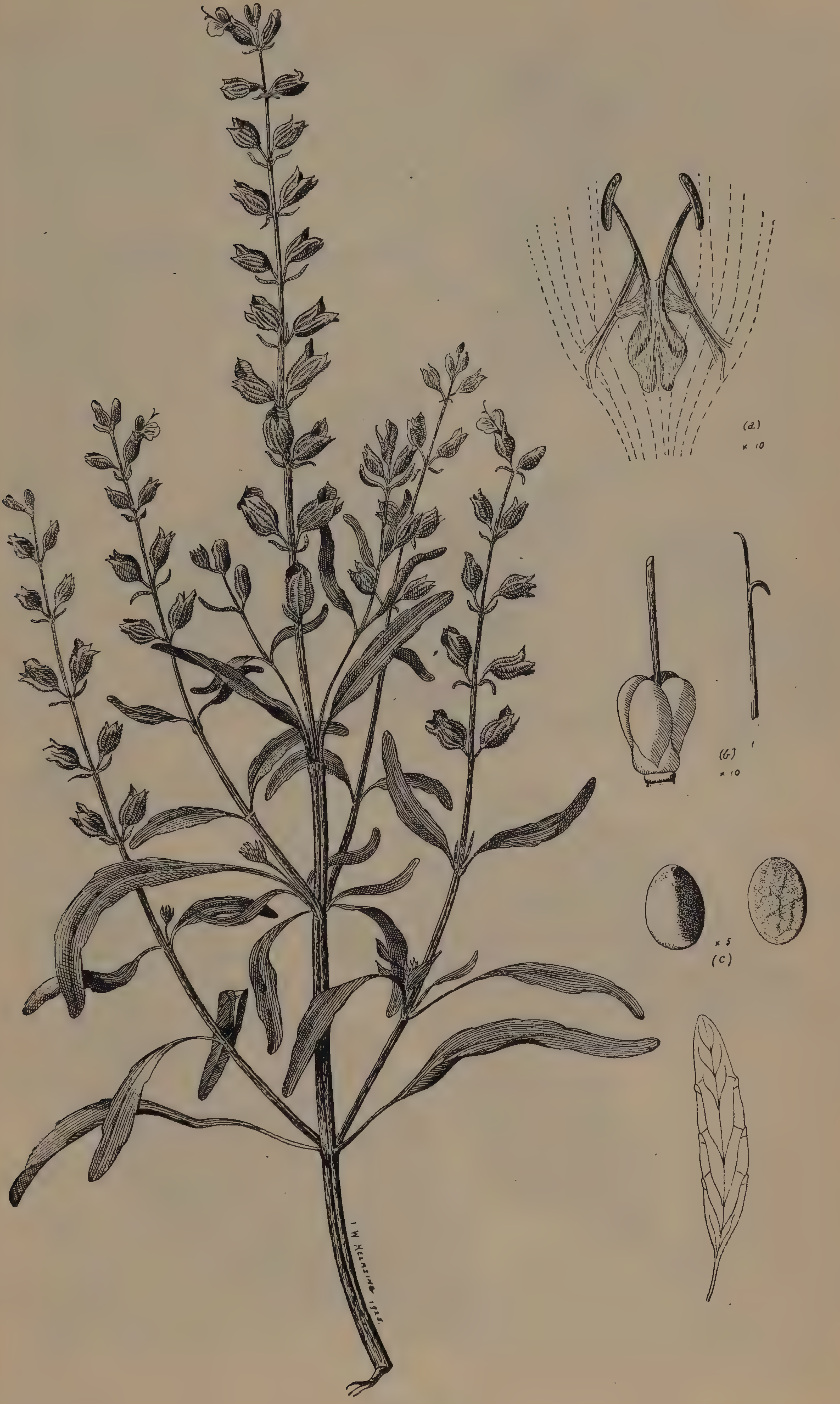

Plate 44.

SALVIA REFLEXA.—Narrow-leaved Sage, Wild Mint, or Mint Weed (Family Labiatæ). A.—Stamens showing the broad and lobed nature of the lower connective (a character of the species). B.—Pistil showing 4-lobed ovary and 2-lobed style (one lobe much longer than the other). C.—"Seeds."

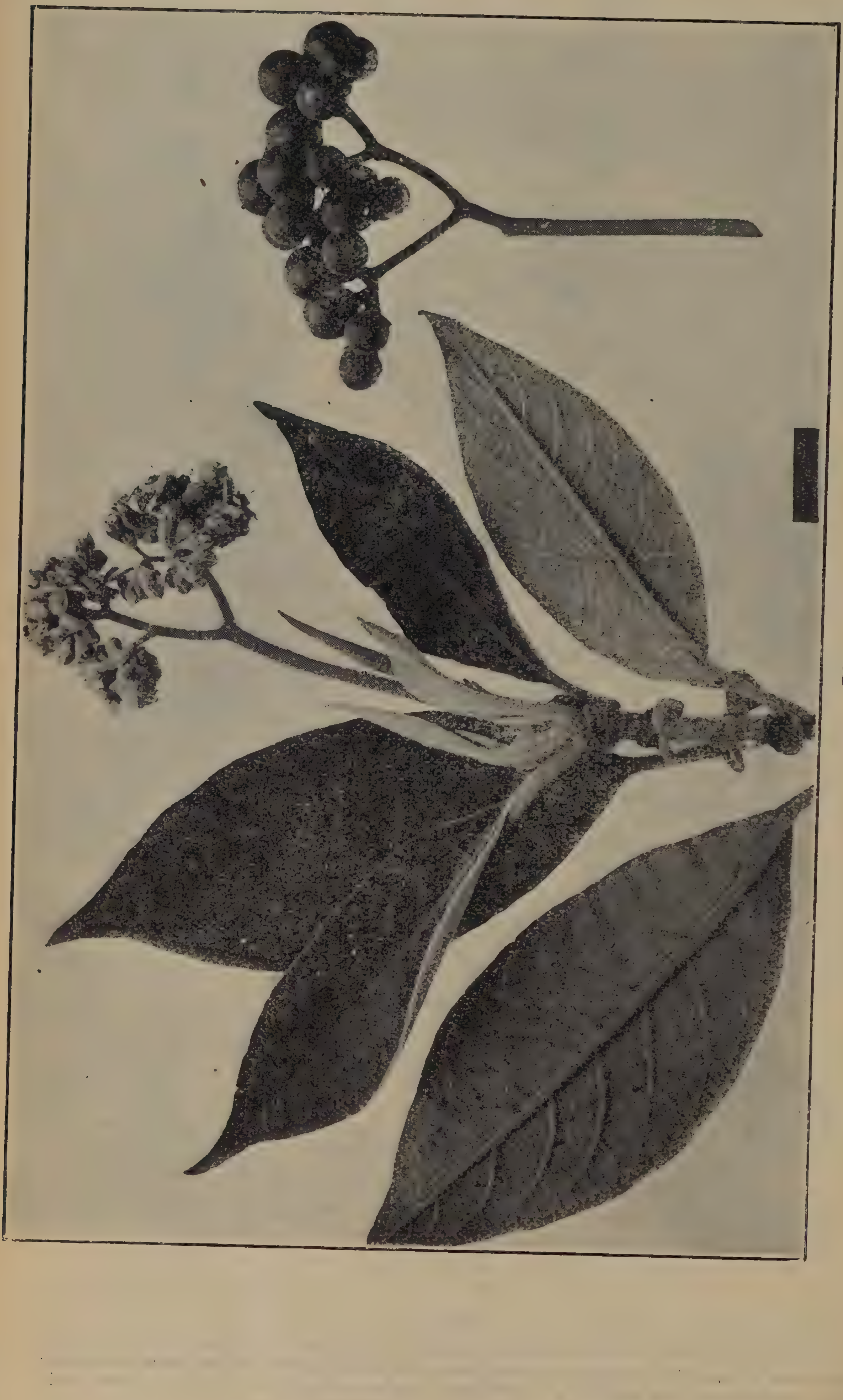

Plate 45.

SOLANUM AURICULATUM—Wild Tobacco (Family Solanaceæ). A very common second-growth weed in coastal Queensland fatally poisoned through sucking a few of the leaves. The leaves contain a mixture of midriatic alkaloids, on which account they have been exported to Germany and England. The demand for the leaf, however, has been erratic. *D. Leichhardtii* is an allied species very common in parts of the Southern Burnett District, particularly between Kingaroy and Nanango. The third species, *D. Hopwoodii,* is the Pituri, well known as a narcotic in use among the aborigines. It is only found in Queensland in the extreme south-west . It is abundant in Central and Western Australia, and is fairly common along parts of the Trans-Australian Railway.

The family contains several imported weed-pests, some of which are poisonous to live stock. A frequent weed of cultivation is *Datura stramonium,* the common Stramonium or Thorn Apple. It has rather a nauseating odour and taste in the green stage, and the living plants are rarely eaten by stock. Several cases, however, are on record where the plants have been cut and chaffed with the standing crop and subsequently fed to animals with fatal results. The leaves are dried for use as a tobacco by sufferers from asthma. Several other weeds of the same genus are naturalised in Queensland, and all possess similar poisonous properties.

The family contains some very important economic plants. Among them are the Potato (*Solanum tuberosum*), Egg-fruit (*Solanum Melongena*), Tomato (*Lycopersicum esculentum*), Capsicums or Chillies (*Capsicum annum,* annual species and *C. frutescens,* shrubby, perennial species), and Tobacco (*Nicotiana Tabacum*). It includes several important drug plants as Belladonna or Deadly Nightshade (*Atropha Belladonna*) and Henbane (*Hyoscyamus niger*).

FAMILY RUBIACEÆ.

A family of trees, shrubs, herbs, or climbers. Leaves opposite or sometimes whorled. Stipules interpetiolar (see p. 227). Flowers mostly arranged in cymes, sometimes solitary. Calyx-tube adnate to the ovary, limb entire or with several teeth or divisions. Corolla 3-5-toothed or lobed. Stamens as many as the corolla lobes and alternating with them. Ovary inferior. Fruit various—a drupe, berry, capsule, or indehiscent nut.

A large family widely spread over the world but finding its greatest development in tropical regions. It is well represented in the Queensland flora, though none of the species are of particular economic importance. It contains the coffee (*Coffee arabica* and to a less extent *C. robusta*) and Quinine (*Cinchona* spp.).

FAMILY COMPOSITÆ (THE COMPOSITES).

A family mainly of herbs, sometimes shrubs or climbers, rarely trees. Leaves simple but sometimes very much cut and divided, opposite or alternate. Flowers arranged in heads, surrounded by an involucre of bracts either in a single or in several series (see Plate 155, page 362, figs. 2 and 3). Calyx wanting or converted into a *pappus,* usually consisting of plumose hairs, sometimes of scales or barbs. Corollas tubular or ligulate. (In Plate 46, fig. A represents a ligulate and fig. B a tubular corolla, respectively). Stamens 5 (rarely 4), the anthers united in a sheath round the style.* Ovary inferior. Fruit a small, seed-like nut or achene, crowned by the pappus or naked.

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* In the Noogoora Burr and Bathurst Burr (genus *Xanthium*) and in the Wormwood and Rag Weeds (genus *Ambrosia*) the anthers are distinct. These plants are regarded by some botanists as constituting a distinct family—the Ambrosiaceæ—apart from the Composites.

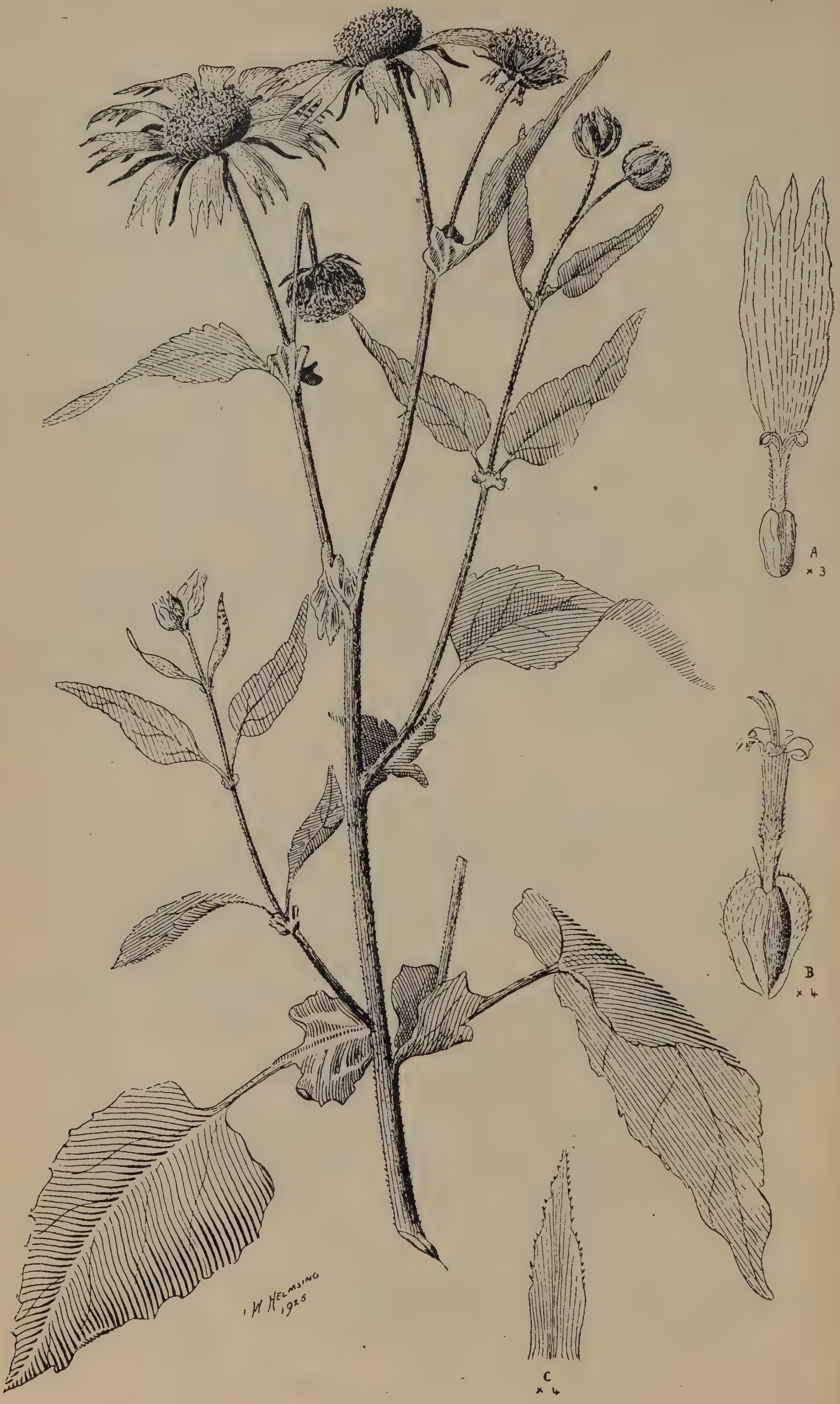
A
× 3
B
× 4
C
× 4
W HELMSING
1925

Plate 46.

Wild Sunflower of America or Dogweed (*Verbesina enceliodes* Benth. et Hook). Family Compositæ. A.—Ray floret. B.—Dish floret. C.—Involucral scale.

A very large family widely spread over the world. It is strongly represented in the Queensland flora by over 200 species. Many are common naturalised weeds—*e.g.*, Billy Goat Weed (*Ageratum conyzoides*), Mist Flower (*Eupatorium riparium*), Horse Weed (*Erigeron linifolius*), Cobbler's Pegs (*Bidens pilosa*), Noogoora Burr (*Xanthium spinosum*), Federal Weed (*Erechthites valecianæfolia*), Jo Jo Burr (*Soliva sessilis*), Stinking Rodger (*Tagetes glandulifera*), Milk Thistle (*Sonchus oleraceus*), Flat Weed (*Hypochœris radicata*), Dandelion (*Taraxacum officinale*), &c.

Part V.—PLANT GEOGRAPHY AND ECOLOGY.

Plant Geography has for its study the distribution of plants over the surface of the earth. *Ecology* is a branch which has come much to the fore in recent years, and concerns itself with the study of the individual plant or of particular groups of plants in relation to their environment.

CHAPTER XXV.

The Plant Associations of Queensland.

The vegetation of the world has been roughly classified by botanists into the three main divisions of Grassland, Woodland, and Desert. Of these only the first two occur in Queensland. We have, it is true, country popularly called desert, but in reality this is a form of woodland, as it not only contains various grasses and herbage, but small trees and shrubs. What is called desert in Queensland, as a matter of fact, possesses a varied flora, and is extremely interesting country from the point of view of the botanist.

The Grass Lands or Pastures.

Natural grasslands of very extensive range are represented in Queensland by the rolling downs formation and covered by Mitchell, Flinders, and other grasses and herbage characteristic of Western parts of the State.

These pastures are of a sufficiently high standard to be famous throughout Australia. Of the grasses composing the pastures the best known are the Mitchell Grasses, Flinders Grasses, native Panic Grasses, Blue Grasses, better-class Star Grasses, Love Grasses, &c. Here and there on the Darling Downs and in the Granite Belt Danthonia Grasses, such as *Danthonia pallida*, *Danthonia racemosa*, and *Danthonia longifolia*, are of some importance, though not nearly to the same extent as they are in the colder places further to the south, such as the New England Tableland. Annual herbs following the summer rains are a feature of much of the grass land. These belong to a great range of families, the Amaranths, the Saltbushes, the Legumes, and the Mallows being among the most valuable.

Mitchell Grasses.

Now, to deal with some of the grasses individually. Undoubtedly the grasses most associated with Australia, both in the country itself and abroad are the Mitchell Grasses. The Barley Mitchell Grass (*Astrebla pectinata*) was found by Sir Thomas Mitchell near Condobolin and on the plains of the Bogan in New South Wales in 1836. These were described at the time by the great English botanist, Charles

Lindley, as *Danthonia pectinata*, and are to be found preserved at the present time at the Museum and Herbarium of the Department of Botany of the University of Cambridge, England. Though Mitchell is generally regarded as the discoverer of Mitchell Grass, specimens had already been collected by both Cunningham and Fraser as early as 1817, though, apparently, they remained undescribed and, indeed, unrecorded at all until C. E. Hubbard, when monographing the genus, found the specimens at the British Museum of Natural History, London. The Mitchell Grasses are widely spread over the heavy blacksoil plains of Northern Australia, Central Australia, Queensland, and New South Wales, but find their greatest development in Queensland. The genus is confined to Australia. Four distinct species are to be recognised:—

1. *Astrebla pectinata*, often known as the Common Mitchell, is the commonest form in New South Wales, but is comparatively rare in Queensland. It has a wide distribution through Central Australia to Western Australia, but in the lastmentioned State is, I understand, very rare.

2. *Astrebla lappacea*, known as the Wheat-eared or Curly Mitchell. This is the form most abundant in Queensland. Like the Common Mitchell, it has a wide distribution, but is nowhere so abundant as in Central Queensland. It has a long, wheat-eared seed-head, and is probably the most important species of the genus from an economic standpoint. In the older literature it is referred to as *Astrebla triticoides*, but this excellent specific name has, unfortunately, to give way on account of priority to *Astrebla lappacea*. This latter name was used by Lindley as far back as 1848, when he named the grass *Danthonia lappacea*, based on specimens collected by Sir Thomas Mitchell, near Mitchell, Queensland, in 1846.

3. *Astrebla squarrosa* is the Bull Mitchell, moderately common in parts of Central and North Queensland, also found in the Northern Territory and the north-west of New South Wales. It is a coarse species not occurring in such quantities as *Astrebla lappacea*, and not regarded as the equal of the common *Astrebla lappacea* as a stock grass. It yields a very large seed-head and a correspondingly large grain.

4. *Astrebla elymoides*.—This is variously known as the Hoop Mitchell, Wire Mitchell, and Weeping Mitchell. It is very distinctive looking from all the others, and has a wide distribution through the north-west of Western Australia, Northern and Central Queensland to New South Wales. It is quite a good fodder grass, very drought-resistant, but suffers in comparison with its better relatives.

FLINDERS GRASSES.

Ranking next in importance to the Mitchell Grasses in the eyes of the pastoralists of Northern and Western Queensland are the Flinders Grasses, of which seven distinct kinds have now been recognised. They all belong to the genus Iseilema, which is composed, so far as known, of twelve species, five of which are found in tropical Asia and seven in Australia. Until recent years all the Australian kinds were looked upon as forms of one species. During the summer months of 1909-1910, the Czecho-Slovakian botanist, Dr. Karel Domin, botanised extensively in Queensland, and he paid special attention to the grasses, making extensive collections. He recognised four distinct species among the grasses known collectively as Flinders Grass. Later, C. E. Hubbard, an English botanist, and probably the leading grass systematist of the world, spent twelve months' work in Queensland. He has recently monographed the genus and recognised seven distinct species. The value of Flinders Grasses lies in their peculiar habit of growing extremely palatable and nutritious in the form of standing hay, in this respect differing from practically all other grasses. The nutritive value is due to the amount of grain produced and the peculiar way in which it is borne among small leaves over almost the whole plant. The Flinders Grasses are extremely brittle when dry, but all stock greedily lick up the broken

Plate 47.

Bull Mitchell Grass (*Astrebla squarrosa*) in a slight depression on plain at Claverton, between Charleville and Cunnamulla. The tussocks are evident. In the foreground seed-heads of the grass are seen.

[*Photo. by W. D. Francis.*

Plate 48.

The stock route on the Ward Plain, about 12 miles north-west of Charleville. The vegetation shown in the foreground consists of low-growing Salt Weed (*Threlkeldia procoriflora*) and two low-growing burr-bearing plants (*Bassia echinopsila* and *B. anisacanthoides*).

[*Photo. by W. D. Francis.*

pieces and do well on them. As a hay crop for dry tropical and subtropical regions with a short summer rainfall season, the Flinders are probably unequalled, making up in high nutritive value what they lack in bulk.

BLUE GRASS.

Extremely important on the Downs country of Queensland and New South Wales, and particularly in this State, is the Blue Grass *(Dichanthium sericeum),* in its typical form distinguishable in the field by its bluish-green colour, luxuriant appearance, and soft silky seed-heads. A number of forms are distinguishable, and they are at present under review by Mr. C. E. Hubbard, whose classification of them is looked forward to by botanists and agrostologists. One may say: "Why worry about the finer points of the classification of these grasses at all? Where does it lead?" But surely it is hardly necessary to point out that a good sound botanical classification is the basis on which all future work on the improvement of the grasses by selection and hybridisation rests. Blue Grass has an exceptionally high reputation as a fodder among pastoralists. It is usually one of the earliest grasses to shoot in response to spring and early summer rains, but is not particularly drought-resistant. It makes one of the best hays possible, and as it produces an abundance of seed it is worthy of study from the agrostologist and plant breeder. E. Breakwell, in his excellent book on "The Grasses and Fodder Plants of New South Wales," states that it has been found that the smallest and plumpest spikes produce the best seed.

PANIC GRASSES.

Forming a very large percentage of the bulk of the average native mixed pasture are the various sorts of Panic Grasses. These were all included in the earlier works on Australian grasses under the genus Panicum. This genus has now, however, been divided into numerous smaller genera, the genus Panicum itself, in a restricted sense, being comparatively small, and including, for the most part, grasses with widespreading, much-branched seed-heads, such as *Panicum decompositium,* often referred to as Native Millet, *Panicum trachyrachis,* Coolibah Grass, *Panicum prolutum,* Coolah Grass, and a number of others, common enough in the pasture but lacking distinctive local names. As at present understood, twenty different kinds of Panicums, or Panic Grasses proper, are found in Queensland.

PASPALIDIUM GRASSES.

Of the grasses split off from the Panicums by modern botanists are those forming a group now known as the Paspalidium Grasses. Paspalidium is a small genus of about sixteen species, of which ten are found in Australia, all the Australian species being found in Queensland, though many extend to New South Wales and the Northern Territory. They are remarkable for the great amount of grain they carry in narrow, spike-like heads. Most of them are extremely palatable. The largest is *Paspalidium globoideum,* known as Shot Grass or Sago Grass in Queensland. It grows 3 feet to 4 feet high or more, is extremely palatable to stock, and bears a sago or tapioca-like grain. This grain is borne in great abundance, and is one of the staple foods of the grain-eating birds in the West; in fact, one pastoralist, Mr. J. Garvey, of Fernlees, Central Queensland, in sending specimens of this grass along with other Paspalidiums stated that that the budgerigars fed so heavily on the seed that the grass did not get a chance to establish itself properly. This does not, of course, apply only to this particular grass but to others, including the Mitchell Grasses, &c. Among the smaller growing Paspalidiums are several known as Brigalow Grasses. A good deal of prominence has been given to one of these (*P. cœspitosum*) in the Queensland Press, and following this a good deal of interest has been focused on this particular grass and its allies.

Paspalidium flavidum is a large species intermediate between the smaller Brigalow Grasses and the Shot Grass or Sago Grass (*Paspalidium globoideum*). Of the Brigalow Grasses proper we can now, I think, recognise at least three distinct species, namely:—*Paspalidium gracile, Paspalidium distans,* and *Paspalidium caespitosum.* At the present stage of our knowledge I do not care to state which is the best. Probably the values are more or less similar; but, in any case, they represent a very fertile field for intensive work by agrostologists in the future.

Many other grasses go to make up the mixed native pasture—Love Grasses, Kangaroo Grasses, Oat Grasses, Star Grasses, &c.—but time does not allow to deal with these in any detail. However, farmers, pastoralists, and others are invited once more to forward specimens of grasses and herbage to the Department for identification and report.

Forest Grasses.

Though scarcely grassland in the strict botanical sense, but rather an undergrowth in the open or savannah forest, it might be convenient to treat the forest grasses and herbage here. Excellent cattle pasturage exists along much of the coastal portions of the States. Typical tropical savannah forests, consisting of low eucalypts, wattles, Proteaceae, and other trees with an undergrowth of grasses and herbage, are found over much of the Cape York Peninsula, improving as one comes south to the Gulf country, where a great mixture of grasses and herbage occurs in the pastures, grass genera represented being *Andropogon, Aristida, Arundinella, Alloteropsis, Chloris, Chrysopogon, Cynodon, Ectrosia, Eragrostis, Eriachne, Panicum, Pappophorum, Paspalum, Rottboellia, Setaria, Sorghum, Themeda,* &c.

Southward from Ingham, through Townsville to Proserpine, there is a " dry " belt; the native pastures are mostly coarse in appearance, and, in a lot of the open forest country, Blady Grass *(Imperata)* and Spear Grass (*Heteropogon*) predominate. During the wet season some of the larger grasses, such as the Tall Spear Grass *(Heteropogon triticeus*), the native Sorghums (*fulvum, australe,* and *laxiflorum*) grow to a great height—8 to 10 feet—or even more. Some of the best pastures in the open Eucalyptus are composed of Kangaroo Grass *(Themeda)* almost in a pure stand.

Of recent years anywhere near a settlement, *Chloris barbata,* noticeable on account of its purple heads, has become the outstanding grass in the native pastures. It has been highly spoken of, but it is rather doubtful if it has any very great value.

The common tropical weed *Stylosanthes sundaica* (Wild Lucerne) has spread everywhere, greatly improving the pastures. Cattle are very fond of this leguminous plant, and analysis shows its feeding value to be high. Unfortunately it is only of annual duration, and dies out on the approach of the dry winter months.

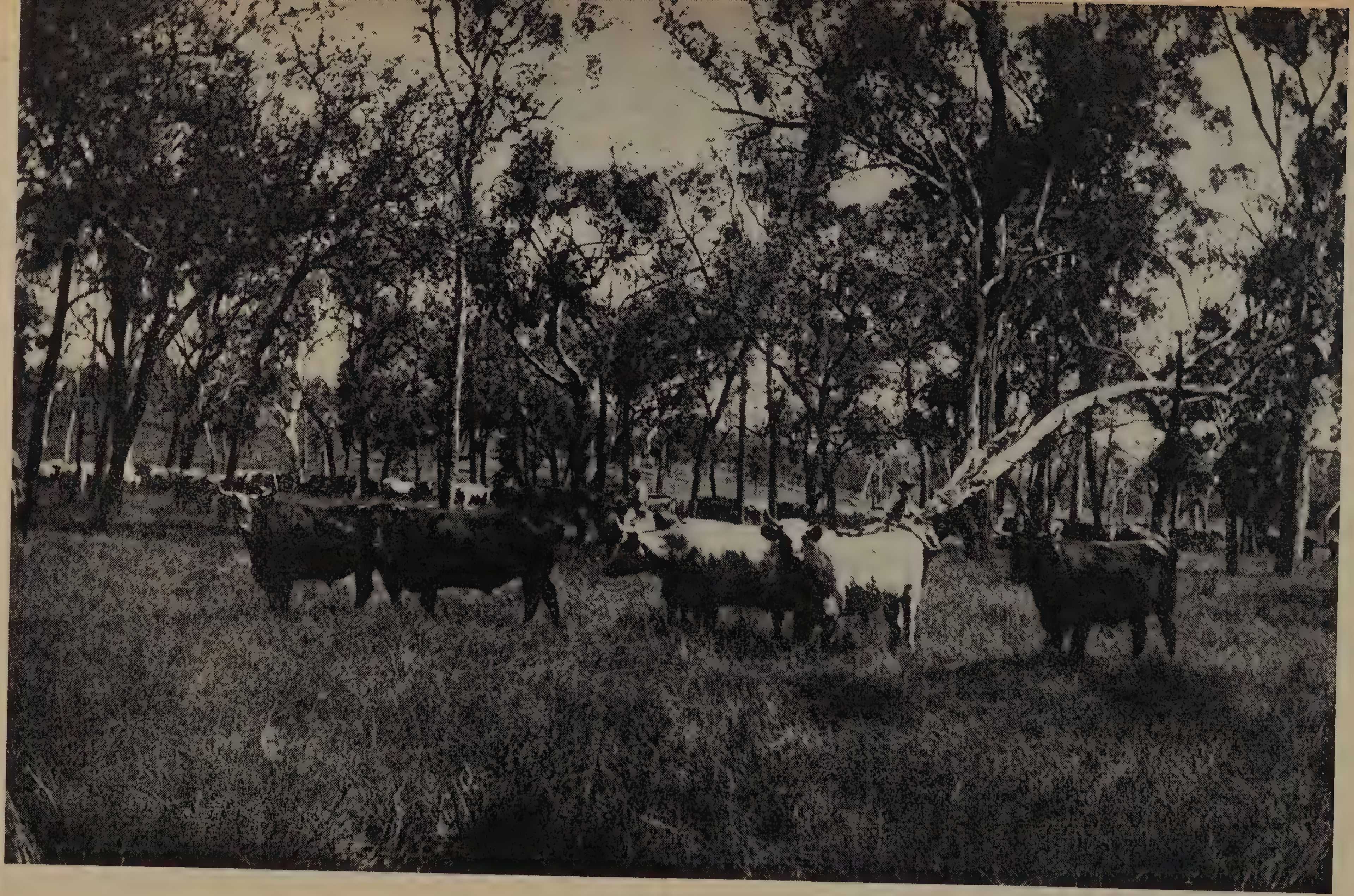

Plate 49.

Typical grass-land forest (Savannah forest or park-land), Taabinga. Beef cattle in foreground.

From Proserpine southwards to Koumala the rainfall is high, but this is essentially sugar country and stock-raising is of little consequence; but from Koumala southwards to about Gladstone is another "dry" belt. In the more northern portions the pastures are much the same as those between Ingham and Proserpine, except that conditions are a little less tropical, and *Stylosanthes* is not a predominating feature in the summer pastures. As one comes south the pastures differ considerably, carrying in many cases a very heavy mixture of species, though they suffer severely from continued dry spells, particularly in the winter and spring months. The principal grasses composing the pastures are *Dichanthium* spp. (Blue Grasses), *Themeda* (Kangaroo Grasses), *Alloteropsis* (Cockatoo Grass), *Chloris* spp. (Star Grasses), *Cynodon* spp. (Couch Grasses), *Eragrostis* spp. (Love Grasses), *Eriochloa* spp., *Panicum* spp. (Panic Grasses), *Pappophorum* spp. (Whiteheads), *Sorghum* spp. (Native Sorghum), *Setaria* spp. (Native Millets), *Sporobolus* spp., &c.

In some parts of Central Queensland, such as the Dawson Valley, native pastures are those of the coastal type, except that some of the better Western grasses such as the Mitchell Grasses *(Astrebla* spp.) Flinders Grasses *(Iseilema* spp.), and some of the better Panic Grasses intrude.

From Gladstone southwards the native pastures vary in quality from good to very poor. In the better pastures Kangaroo Grass (*Themeda*), Blue Grass (*Dichanthium*), *Chrysopogon* spp., Love Grasses (*Eragrostis* spp.), and Native Panic Grasses (*Panicum* spp.) predominate. In the poorer pastures, particularly those on sandy or clayey soils, Spear Grasses (*Aristida* spp.) and a general mixture of varying poorer sorts compose the bulk of the pasture.

In the Burnett, Lockyer, and Brisbane Valley areas, the better open Eucalyptus country supports native pastures for the most part of a high order, consisting of a general mixture of Blue Grasses, Panic Grasses, Kangaroo Grasses, &c. Herbaceous plants comprising a fair number of legumes are also a feature of these pastures. A good deal of the country has suffered badly from overstocking, with the consequence that the better mixtures have been eaten out, leaving in many cases almost a pure stand of the Bitter Blue Grass (*Bothriochloa decipiens),* a very inferior species. The poorer pastures consist mostly of Blady Grass (*Imperata*), Barb-wire Grass (*Cymbopogon refractus*), Spear Grasses *(Heteropogon* and *Aristida* spp.), Burr Grass *(Cenchrus),* &c.

An interesting feature has been the alteration in some localities—particularly near Brisbane—of the composition of the native pasture. In most cases this has deteriorated through overstocking, but in many cases, especially in the better forest (Eucalyptus) soils, the original mixture has given way to pastures almost entirely composed of the Blue Couch (*Digitaria didactyla*) and here and there in similar areas the Common Couch (Cynodon), and this possibly has improved the carrying capacity of the pastures. Both Couches are regarded as native grasses, but it is only of comparatively recent years, about the last twenty, that the Blue Couch seems to have come into any prominence.

FRESH WATER GRASSES.

A distinct type of pasture in coastal Queensland are fresh-water swamp pastures of a high grazing value. In these the following grasses are the most important:—Water Couch *(Paspalum distichum)*, White Water Couch *(Panicum obseptum)*, Rice Grass *(Leersia hexandra)*, *Hemarthria compressa*, Native Millet *(Echinochloa)*, and a few others of less consequence.

Salt Water Meadows.

Grasslands of a relatively small extent, but important in some areas, are pastures near the sea composed of salt-loving grasses. In some places the salt meadow consists of almost a pure stand of Saltwater Couch (*Sporobolus virginicus* var. *minor*). In other areas the Maritime Rush *(Juncus maritimus* var. *australiensis)* may form almost a pure stand of several acres in extent though it is generally associated, particularly on the edge of the swamps, with various sedges and allied plants. Succulents are typical of the salt-meadow, the commonest being Glasswort *(Salicornia)*, Sea Blite *(Suaeda)*, a Salt Bush (*Enchylaena*) and a creeping plant, *Sesuvium portulacastrum*.

Woodland Areas or Forests.

The Woodland areas or forests can be divided along broad lines into several distinct types:—(1) The Littoral or Coastal forests; (2) the Sub-Littoral forests; (3) the Open Eucalyptus forests; (4) the Vine Scrubs or Jungles (known to the botanist as rain forests); (5) the River forests; and (6) the Inland scrubs.

Littoral or Coastal Forests.

MANGROVE FORESTS.

The Littoral forests are of two main types. The forest below high-water mark (mangrove forests), and those above high-water mark (beach forests). The mangroves are extremely interesting trees, showing a wonderful adaptability to the conditions under which they grow. Their roots not only act as a means of anchoring the trees firmly in the muddy substratum in which they grow, but the parts above water also act as breathing organs. They are covered by breathing apertures known as lenticels, are of a spongy nature, and through the lenticels communication with the atmosphere is maintained. This is very essential, as the trees are growing in a very badly aerated soil, and unless communication between the subterranean roots and the atmosphere was established in some way the trees would become suffocated. The fruits are also peculiar from the fact that germination takes place while still on the tree, and the young plant is ready to anchor itself in the mud as soon as it drops from the parent tree; if this did not happen the seeds would become washed about from place to place and difficulty would be found in finding a footing.

Common mangroves of the Queensland coast are the Red Mangrove *(Rhizophora)*, the Black Mangrove *(Bruguiera)*, the small Mangrove *(Ceriops)*, the White Mangrove *(Avicennia)*, and the Milky Mangrove *(Excaecaria)*. The first two are of some importance as tanning agents, but they have not found general favour amongst tanners in Australia owing to several disadvantages. These disadvantages can be overcome, but the expense of doing so does not compensate tanners for the trouble involved.

The White Mangrove is one of the few species of mangroves that extends outside the tropics, being common all round the Australian coasts, and extending to New Zealand. The bark of this tree has no value for tanning purposes, but the leaves are of use as a fodder, and in times of drought in coastal areas the White Mangrove has saved many head of stock.

The Milky Mangrove is poisonous and possesses a milky sap with strong blistering properties. If it gets into the eye it causes intense pain and temporary blindness.

An interesting member of the mangrove flora in some parts of North Queensland is the Nipa Palm *(Nipa fruticans)*. The Nipa Palm is at present confined to a few parts of North Queensland, the Pacific Islands, and tropical Asia, but at one time evidently had a wide range over the regions of the world, as nuts in a good state of preservation are commonly found in the Tertiary deposits at the mouth of the Thames in England. Where it grows the leaves of the Nipa Palm are preferred above all others as thatch for native houses.

BEACH FORESTS.

The Littoral forests above high-water mark are of two types—those of the dry land, and those of the swamps. Those of the former are again divided into two types—(1) Those of the ocean foreshores, and (2) those of the bay foreshores. The two outstanding trees of the ocean foreshores or sand dunes of Eastern Queensland are the Coast Oak *(Casuarina equisetifolia)* and one or two species of Pandanus. The latter show great adaptability to their environment, for they are provided with prop roots, which anchor the trees very firmly in the loose sandy soil in which they grow. These prop roots are essential, as the large leaves and the large heavy heads of nuts are borne at the extreme ends of the branches, and but for these roots the trees would very easily be blown over by the high winds which prevail on the coast.

Another tree often seen on the foreshores immediately behind the dunes is the Sand Cypress *(Callitris columellaris)*. When growing in such situations it is usually rather dwarfed, and the tops cut off in an oblique direction by the prevailing winds, giving the crown a sloping appearance.

Common trees on the bay foreshore often just above the mangrove formation are the Cotton tree (*Hibiscus tiliaceus*), and the Cupania (*Cupania* or *Cupaniopsis anacardioides*).

Trailing sand-binders are characteristic plants of all coastal sand dunes. Along the sand dunes in Queensland are found the universal *Ipomoea Pes-caprae* (the Goat's-foot Convolvulus), *Vigna lutea* with yellow and *Canavalia obtusifolia* with rather purplish-pink flowers respectively; *Acacia longifolia* var. *Sophorae*, common on the more southern beaches, has prostrate stems 10 or 12 feet long trailing over the sand. *Stephania hernandiæfolia* is common just behind the sand dunes, as is *Hibbertia volubilis;* these last two plants seem to be equally at home on the sandy beaches as in the rich tropical and sub-tropical rain forests, two habitats the opposite of one another as far as conditions for plant life are concerned. Sand-binding grasses are represented by *Spinifex hirsutus, Zoysia pungens* (Coast Couch), *Ischæmum triticeum, Lepturus repens, Thuarea sarmentosa,* and *Stenotaphrum subulatum.*

Succulent plants are characteristic of coastal floras. Along the sand dunes in Queensland succulent plants are represented by *Mesembryanthemum aequilaterale* (Pig Face), *Tetragonia expansa* (New

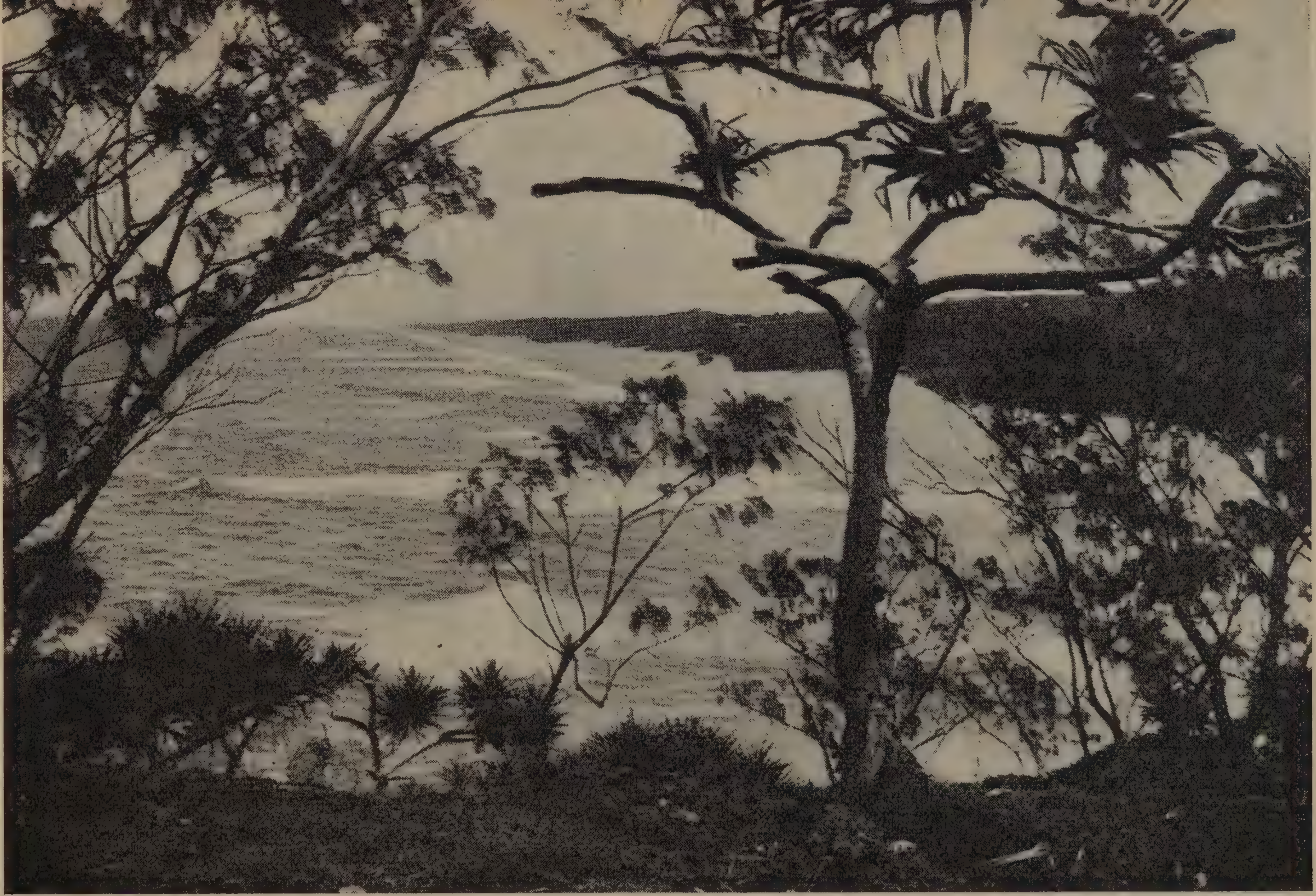

Plate 50.

Noosa Beach from top of Paradise Caves, showing Pandanus (*Pandanus pedunculatus*) and She-Oak (or Sheoke) trees (*Casuarina equisetifolia*). [*Photo., Queensland Government Tourist Bureau*.

Zealand Spinach), *Cakile maritima, Scaevola suaveolens,* and the two spurges *Euphorbia atoto* and *E. eremophila. Oxalis corniculata* (Wood Sorrel) and *Sonchus maritimus* of a less succulent nature are also common on many beaches. *Sesuvium portulacastrum,* sometimes found on the dunes, is more abundant on the saltpans.

SUB-LITTORAL FORESTS.*

I have applied the term sub-littoral forests to two types of woodland—(1) Coastal swamps or tea-tree swamps, and (2) the country known universally in Queensland as " wallum "; these are essentially coastal types, though they may continue inland for about 10 miles, or in more isolated patches for even more.

COASTAL FRESHWATER SWAMPS.

Lying close in from the beach in much of coastal Queensland are very large freshwater swamps. The outstanding tree of these swamps is the common Paperbarked or Broad-leaved Tea-tree *(Melaleuca viridiflora* and its allies). Where this tree grows the ground is often covered with a thick growth of the Bungwall Fern (*Blechnum serrulatum*), and its rhizomes sometimes climb up the trees through the outer layers of the papery bark for quite a considerable distance. Another fern often so common as to be an outstanding feature of the vegetation is the so-called Climbing Maidenhair (*Lygodium scandens*). In some parts the Tea-tree is displaced by the Swamp Oak *(Casuarina glauca).* Other trees present in these coastal swamps are *Eucalyptus robusta* (sometimes called Swamp Mahogany), *Tristania suaveolens* (the Swamp Mahogany), and to a lesser extent Eucalyptus umbellata (*Synonym Eucalyptus tereticornis)*, the Queensland Blue Gum.

The trees of these coastal swamps have to withstand conditions very unfavourable to plant growth—*i.e.,* periods of inundation alternating with those of comparative drought—so that they are mostly xerophytic in habit, with tough, leathery, commonly vertically placed leaves, and some, such as the Blue Gum, Swamp Mahogany (*Tristania*), and Tea-tree, can adapt themselves to ordinary dry forest conditions. *Melastoma malabathricum* is a common shrub of the coastal swamps. It is known to Queensland children as Blue-tongue, as the fruits when chewed stain the mouth bluish black all over.

In the wetter parts where the water is more permanent aquatic plants as the Water Lilies (*Nymphæa* spp.), of which the commonest is the Blue Water Lily (*N. gigantea*), Swamp Lily (*Ottelia*), the Fringed Water Lily (*Limnanthemum*), Bur-reed (*Sparganium angustifolium*), Bulrush (*Typha angustifolia*), and various sedges and allied plants are found growing.

Water grasses are represented by the Dutch Millet *(Paspalum orbiculare),* the Water Couch *(Paspalum distichum),* Wild Millet (*Echinochloa*), Rice Grass (*Leersia*), Common Reed (*Phragmites*), and others.

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* The Latin prefix ''sub,'' meaning under or below, is very frequently employed in botany in compound words, and implies an approach to the condition indicated; *e.g.,* sub-littoral forests are forests close to the sea but not actually on the shoreline; sub-tropical forests are forests not actually growing in the tropics but approaching the tropics or tropical richness very closely; leaves sub-opposite means that the leaves are not quite but nearly opposite, and so on.

"WALLUM."

The term "Wallum" is applied in Queensland to barren country in the coastal belt covering large areas, particularly in the Moreton Bay, Wide Bay, and Hervey Bay districts. It consists largely of peat swamps, in some places very wet, alternating with sandy ridges covered with a fairly dense woodland consisting of low, stunted eucalypts, *Banksia*

Plate 51.

LAKE COOTHARABA.—The trees in the foreground are Broad-leaved or Paper-barked Tea Trees (*Melaleuca viridiflora*). This species often forms pure stands of many acres in freshwater swamps near the sea.

[*Photo., Queensland Government Tourist Bureau.*

aemula, &c. This latter is the characteristic tree of much of the sandy tracts and is itself known as "Wallum." In the peat swamps *Sphagnum* moss may occur, though it is not so characteristic of this formation as it is in colder countries, and other plants enter mostly into the formation of the peat. The peat swamps of South-eastern Queensland possess a great many flowering shrubs and undershrubs, and during the spring months are usually gay with wild flowers. These include more particularly many Leguminosae, Myrtaceae, Epacridaceae, and Proteaceae endemic in Australia. The Sedges and their allies are also usually well represented. Insectivorous plants, always more or less characteristic of peat swamps (" high moors ") in all parts of the world, are represented by several Sundews *(Drosera* spp.). Grass-trees *(Xanthorrhaea* spp.) are common in most of the " Wallum." Lycopods or Club Mosses to be found there are *Lycopodium cernuum* and *L. laterale,* and in some places the Coral Ferns *(Gleichenia circinnata* and *G. dicarpa)* are very abundant.

The sand hillocks in the " Wallum " contain a very rich mixture of Australian types—Epacridaceae or Australian Heaths, Leguminosae, Myrtaceae, Proteaceae, and Rutaceae predominating.

OPEN EUCALYPTUS FORESTS.

The open Eucalyptus forest (savannah forest), as in the other States of Australia, is the main forest type of Queensland. It varies a good deal in composition of species according to whether coastal or inland, northern or southern, whether occurring on rich deep soils or barren siliceous ones, &c.

Though the Eucalypts in themselves form a very natural group, they present many difficulties at any attempt to arrange the species into natural groups, each group possessing a number of characters in common. As far as the Queensland species are concerned, for the purpose of giving a brief account of the genus, the species can be most conveniently divided into five groups, according to their bark characters, viz. :—

(1) The smooth-barked trees or gums proper with a trunk normally smooth, the bark coming off in scales or strips leaving a clean, smooth barrel; bark commonly persistent at the base of the trunk and very rarely persistent for some time almost up the entire trunk. Characteristic trees of this group are *Eucalyptus saligna* (the Flooded Gum), *E. tessellaris* (the Moreton Bay Ash or Carbeen), *E. maculata* (the Spotted Gum), *E. micrantha* (the Scribbly Gum), *E. Seeana* (Narrow-leaved Grey Gum), *E. propinqua* (the Grey Gum), *E. Torelliana* (Cadagi), *E. platyphylla* (Poplar Gum), and *E. papuana* (Cabbage Gum).

(2) The Boxes with dark-grey, fibrous, much interlocked bark, often shed on the upper part of the trunk and main limbs in strips or patches. Characteristic trees of this group are *Eucalyptus albens* (White Box), *E. conica, E. hemiphloia* (Gum-topped Box), *E. melliodora* (Yellow Box), *E. populifolia* (Bimble Box), *E. pilligaensis* (Ribbon Box), *E. microtheca* (Coolibar), *E. quadrangulata, E. Cambageana* (Mountain Coolibar), and *E. leptophleba* (North Queensland Box).

(3) The Stringybark trees with a very fibrous bark, persistent on the trunk and branches. Typical trees of this group are *Eucalyptus resinifera* (Red Stringybark), *E. capitellata* (Brown Stringybark),

E. eugenioides (White Stringybark), *E. acmenioides** (Yellow Stringybark) and *E. Planchoniana,* &c. Less typical but placed in this group for the purpose of convenience are *E. Baileyana* (Rough Stringybark), *E. microcorys* (Tallow-wood), and *E. exserta* (Peppermint).

(4) The Ironbarks possess a hard-furrowed, black or dark-grey persistent bark, rather friable and the interstices often carrying a dark red kino ("gum"). Typical trees of this group are *Eucalyptus melanophloia* (Silver-leaved Ironbark), *E. paniculata* (Grey Ironbark), *E. crebra* (Narrow-leaved Ironbark), *E. siderophloia* (Broad-leaved Ironbark). The Mugga or Red Ironbark *(E. sideroxylon)* is common along parts of the New South Wales-Queensland border; the bark is often of a more friable nature than the other ironbarks.

(5) The Bloodwoods are trees with a persistent bark, commonly inclined to be spongy and friable and roughly and irregularly tessellated, the outer layers lamellar and the inner layers sub-fibrous. Typical trees of this group are *Eucalyptus corymbosa* (Red Bloodwood), *E. trachyphloia* (White Bloodwood), *E. terminalis* (Western Bloodwood), *E. dichromophloia* (Northern Bloodwood), and the various trees known in Queensland as Yellowjacket—*e.g., E. peltata, E. Bloxsomei, E. Watsoniana, E. similis,* &c.

The Marlocks and Mallees are not represented in Queensland, though a species of mallee-like growth, *E. Bakeri,* occurs in fairly considerable areas in some interior parts along the New South Wales-Queensland border, and in parts of the Burnett District and Central Queensland.

In parts of coastal North Queensland large areas are covered with Broad-leaved Tea Trees (mostly *Melaleuca Leucadendron* var. *Cunninghamii)* at times forming pure stands, but usually mixed with Eucalypts.

A genus allied to Eucalyptus and very much abundant in the open forest is *Angophora,* the best known members of which are the Rusty Gum *(A. lanceolata)* and the Apple-trees *(A. intermedia* and *A. subvelutina). A. melanoxylon* is very common about Charleville, Western Queensland; *A. Woodsiana,* common in South-east Queensland, is popularly known as Apple-tree Bloodwood.

Another genus allied to Eucalyptus is *Tristania* with two species, viz., the Swamp Mahogany *(Tristania suaveolens)* and the Scrub Box (*T. conferta*), very common in forest country. The former, as its name implies, is commonly found in swampy country, but is certainly not confined to it, being found in the ordinary open forest; its timber is preferred above all others for piles and fender posts for wharves, being especially resistant to the attacks of the marine worm or teredo. The Scrub Box, as its name implies, is often found on "scrub" (rain-forest) edges. Its timber is very little cut in Queensland, due probably to its tendency to warp in small sizes.

The Turpentines *(Syncarpia laurifolia* and *S. Hillii)* are timbers that are in great demand for piles, also for fender posts for wharves. They are rarely cut in Queensland, due to their tendency, like the Scrub Box, to warp in small sizes, but are highly useful, very much underrated hardwoods.

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* *E. acmenioides* and the two allied species, *E. carnea* and *E. umbra,* known in Queensland as Yellow Stringybarks, are not regarded in New South Wales as typical of the Stringybark group, and are universally known as Mahoganies.

An interesting member of the open forest is the Sandalwood *(Santalum lanceolatum)*, parasitic on the roots of other trees. The Sandalwood is common throughout Western New South Wales and Queensland. The main port of export for Queensland is Thursday Island. It is not always found in the open forest, and in the more southern parts of the State grows mostly in the inland scrubs. A tree that commonly goes under the name of Sandalwood in Western New South Wales and Queensland is *Eremophila Mitchellii*, also known in the former State as Buddah. The wood is very strongly scented, but is of no value as a "sandalwood," and attempts to get it on the market have always failed. It belongs to a very different family from the true Sandalwoods. When the Sandalwoods were cut out from the Hawaiian Islands, attempts were made to substitute the wood of a tree allied to the Australian Buddah, and like it with a strong scent, but the Chinese buyers would have none of it. It is possible, however, that it will have some value for wood distillation, as the oil it contains should be valuable for use in the manufacture of scents and perfumes, possessing as it does a desirable, heavy, "oriental" odour. Another Santalaceous tree with a faint sandalwood odour is *Exocarpus latifolia* found in varying quantities along the whole coastal belt.

Other trees making up the open forest are various Wattles *(Acacia)*, *Albizzia* (commonly called Acacia), Honeysuckles (*Banksia*), She Oaks (*Casuarina*), Red Ash (*Alphitonia*), Geebungs (*Persoonia*), Cypress Pines *(Callitris)*, Native Cherry *(Exocarpus cupressiformis)*, Kurrajong *(Brachychiton)*, Swizzle *(Timonius Brownii)*, *Grevillea* spp., *Hakea* spp. (Needle Bushes), &c.

RAIN FORESTS.

The vine scrubs or jungles (rain-forests) reach their greatest development in Australia in coastal Queensland. They consist of heavily dark-foliaged trees, and an abundance of climbers; many of the trees produce huge plank buttresses at the base. Queensland genera in which plank buttresses reach their greatest development are *Ackama* (Pink Marara), *Cedrela* (Red Cedar), *Dysoxylon* (Red Bean and Spurwood), *Elaeocarpus* (White or Blue Quandong), *Eugenia* (Water Gum), *Ficus* (Figs), *Geissois* (Red Carrabin), *Sloanea* (Yellow Carrabin), and *Tarrietia* (Booyongs, Tulip Oaks or Stave Woods).

It is rather unfortunate that in Queensland the name "scrub" should have become attached to this rich type of jungle, as the term "scrub," not only in other parts of Australia but in other parts of the world, as well as in botanical terminology, refers to low, stunted vegetation, the direct opposite to that which occurs in the so-called vine scrubs of Queensland. Rain-forest, as the name implies, is dependent on a high rainfall for its luxuriant development, and in Queensland rain-forest of the more luxuriant type is not found in areas possessing a rainfall under 50 inches (1,275 mm.) per annum. Rain forests of an increasingly drier type, the trees smaller, undergrowth less, and of a more general xerophytic type, occur in areas with a rainfall down to 35 inches (about 900 mm.) per annum. Rain forest is a purely coastal type and does not occur more than 100 miles inland. Mostly it is a narrow fringing belt along the coast.

In the southern (extra-tropical) parts of the State many of the trees, including the rain-forest species, are common to New South Wales and Queensland, but in the tropical parts of the State most of

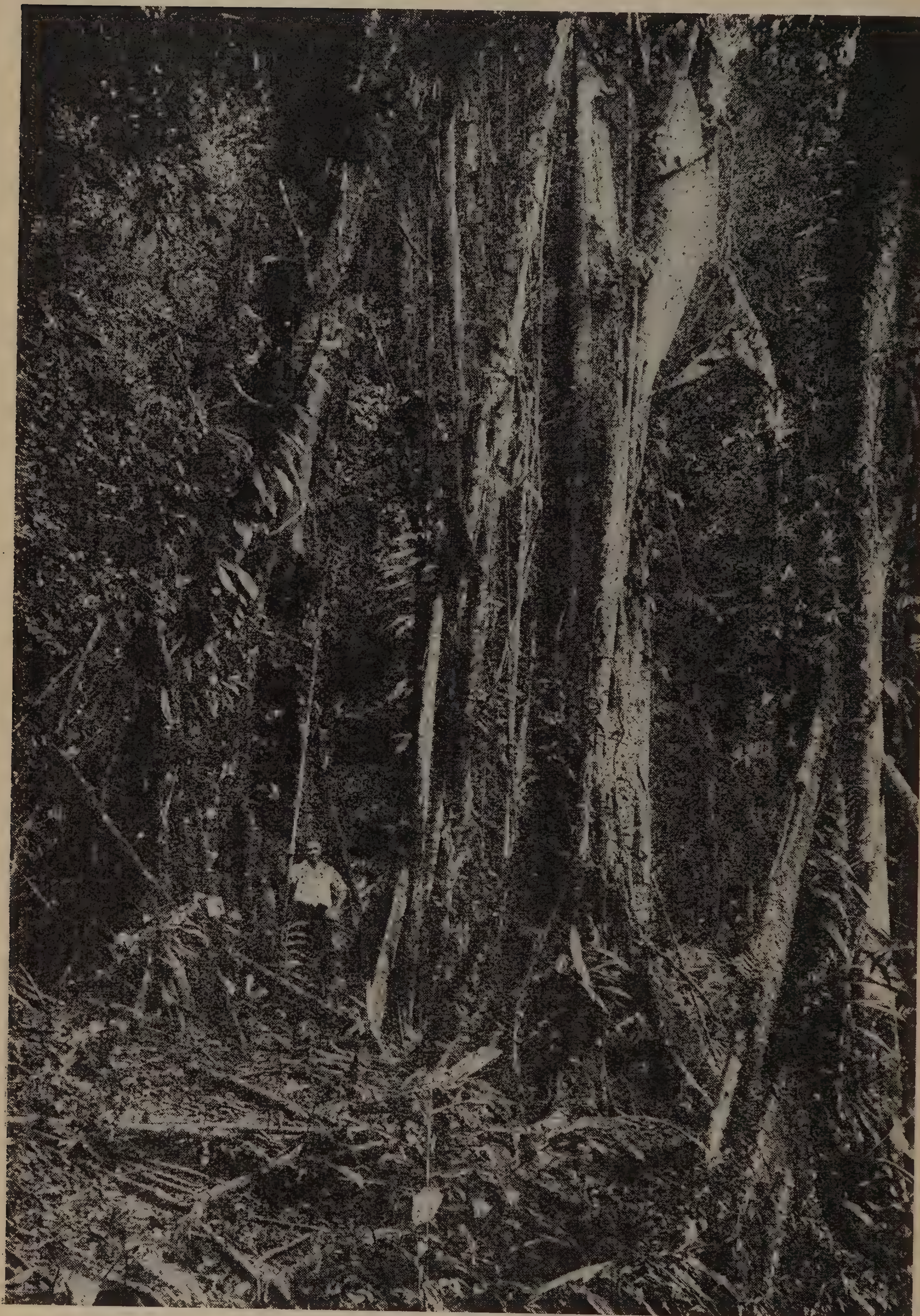

Plate 52.

Tropical rain-forest or jungle with large Banyan Tree (*Ficus* sp.) in foreground, Malanda, North Queensland. [*Photo., Queensland Government Tourist Bureau.*

the species are endemic or if not confined to Queensland spread to either Polynesia, Melanesia, or the Malaysian region, some of them spread over the whole of these areas or with an even wider distribution.

The number of actually Australian types found in the vine scrubs is small, the majority of plants belonging to families, a good few to genera, and a few to species that are cosmopolitan in the tropics and sub-tropics, Malaysian types predominating. Interesting Asiatic types occurring in Queensland are *Rhododendron* and *Garcinia* (the Mangosteens); the former reaches its southernmost limit of distribution in North Queensland, but the latter genus extends to New Caledonia.

An objection is sometimes made to calling many of our rain-forest or jungle plants Malayan types, but the reason for it is that many of the groups such as the Figs, Eugenias, Mangosteens, &c., are found in the Malayan region in far greater abundance than in Australia.

Even in the rain forests, though the Malaysian element may predominate as regards families and genera, the degree of endemism developed among the species is high enough to support the contention of Dr. E. D. Merrill, one of the foremost living authorities on the flora of the Malaysian region, that Australia and Asia have remained separate since the epi-Mesozoic interval or Eocene, a time when the flowering plants had already reached a dominant place in the vegetation of the world. A peculiar feature of the flora of the North Queensland rain forests is the development of a number of small (in some cases monotypic) genera. These are especially numerous among the Proteaceæ, or Silky Oaks, of North Queensland, *e.g.*, *Austromuellera, Buckinghamia, Cardwellia, Carnarvonia, Darlingia, Hicksbeachia, Hollandœa, Musgravea* and *Placospermum.*

The Malaysian tropical element reaches its southern limit in coastal Queensland and New South Wales, and on the other hand, the so-called Antarctic element reaches its northern limit in Queensland rain forests. An interesting example of this latter is the so-called Antarctic Beech or Niggerhead *(Nothofagus Moorei)*, which is abundant on the Macpherson Range.

It is in the rain forest that the most important coniferous softwoods of the State occur, viz., the Hoop Pine *(Araucaria Cunninghamii)*, the Bunya Pine *(Araucaria Bidwillii)*, and the Kauri Pines *(Agathis);* of the last, three species occur in Queensland, of which the one most commonly cut at the present time is *A. Palmerstonii*, of North Queensland. Fortunately the native coniferous timber trees do well under silvicultural conditions and make rapid growth. Podocarps (see p. 757) in the rain forest are represented by the She Pines or Brown Pines, *Podocarpus elata, P. amara,* and *P. disperma; P. Ladei* is a rarer species, so far as known confined to Mount Spurgeon, North Queensland.

The genus *Flindersia* (commemorating the name of Matthew Flinders, the famous navigator) is a genus of about twenty species, all except a few found in Australia, and all the Australian species are found in Queensland. It is an interesting exception as forming a large Australian group found in the rain forests. After *Eucalyptus* and *Araucaria, Flindersia* is probably the most important genus of Australian timber trees. It contains the Crow's Ash or Teak *(F. australis),*

Plate 53.

Second-growth forest composed mostly of Sarsaparilla or Red Ash (*Alphitonia Petriei*), Atherton Tableland, North Queensland. The trees in the foreground with large pinnate leaves are *Polyscias Murrayi*, popularly known in North Queensland as Palm Tree. It is a very characteristic regrowth species. [*Photo., Queensland Government Tourist Bureau.*

Yellowwood *(F. Oxleyana)*, Cudgerie *(F. Schottiana)*, Silkwood *(F. Pimenteliana)*, Maple *(F. Brayleyana)*, Cairns Hickory (*F. Ifflaiana*), and other timber trees.

Other cabinet woods of the Queensland rain forests are the various species of Silky Oaks (Proteaceæ), of which *Cardwellia sublimis* is the most abundant and at the present time the common species of the trade, Red Cedar (*Cedrela Toona* var. *australis*), White Cedar (*Melia dubia*), Red Bean (*Dysoxylum Muelleri*), Black Bean (*Castanospermum australe*), Acacia Cedar or Red Siris (*Albizzia Toona*), Yellow Siris (*Albizzia xanthoxylon*), Booyongs (*Tarrietia* spp.), Red Carrabin (*Geissois Benthamii*), Yellow Carrabin (*Sloanea Woolsii*), Calophyllum (*Calophyllum costatum*), the White Beeches (*Gmelina Leichhardtii* and *G. fasciculiflora*), Rose Walnut (*Cryptocarya erythroxylon*), Tulip Wood (*Harpullia pendula*), Queensland Walnut (*Endiandra Palmerstonii*), Burdekin Plum (*Pleiogynium Solandri*), Daintree Maple or Cairns Pencil Cedar (*Lucuma galactoxylon*), Yellow Hickory, (*Nauclea Gordoniana*), and a number of other timbers not cut to any extent.

On some parts of the Downs and a few other inland localities there is a type of " scrub " which, in addition to trees that also occur on the coast, contains several distinctive ones; the most outstanding is the Bottle-tree (*Brachychiton rupestre*). Trees such as the Lignum-vitæ (*Vitex lignum-vitæ*), Crow's Ash (*Flindersia australis*), *Booyong* (*Tarrietia argyrodendron*), &c., are usually much smaller than the same species in the coastal belt.

Rain-forest or Jungle Regrowth.

When the rain forest is felled and burned it is usually followed by a more or less dense secondary growth. These may consist of imported or native weeds such as Wild Tobacco (*Solanum auriculatum* and *S. verbascifolium*), Ink Weed (*Phytolacca*), Lantana (*Lantana camara*), Thistles, etc., or of trees such as Red Ash or Sarsaparilla (*Alphitonia*), Wattles (*Acacia*), Bleeding Heart (*Homalanthus*), &c.

RIVER FORESTS.

Along many of the Australian freshwater rivers, both inland and coastal, a number of trees occur that always follow the watercourses, being rarely found anywhere else, such as the River Red Gum (*Eucalyptus rostrata*), Red Bottle-Brush (*Callistemon viminalis*), River Tea-Tree (*Melaleuca bracteata*), Weeping Tea-Trees (*Melaleuca leucadendron* vars.) River Oak (*Casuarina Cunninghamiana*), Weeping Myrtle (*Eugenia Ventenatii*), Water Gum (*Tristania laurina*), Gutta-percha (*Excœcaria parviflora*), &c. Other trees such as the Bean-tree (*Castanospermum*), Blue Gum (*Eucalyptus tereticornis*), Lilly Pilly (*Eugenia Smithii*), Creek Cherry (*Eugenia paniculata*), &c., occur along the rivers, but are also found in the vine scrubs or open forests as the case may be.

In the mountain rain forests of the coast characteristic moisture-loving plants growing between boulders in the rocky watercourses are species of *Elatostemma* (Urticaceæ) and *Helmholtzia* (Philydraceæ).

In Western Queensland, as the watercourses dry up the beds may be clothed with a growth of annual herbs of which species of *Centipeda* (Sneezeweed), *Chenopodium* (Goosefoot), *Commelina* (Scurvy Grass), and *Mollugo* (Carpet Weed) are prominent members.

INLAND SCRUBS.

Many scrubs in the western and northern parts of the State are often formed by pure or almost pure stands of particular species of Wattles (*Acacia*), such as the Brigalow (*A. harpophylla*), Mulga (*A. aneura*), Boree (*A. homalophylla*), and Lancewood (*A. Shirleyi*) scrubs respectively. Another tree forming large inland scrubs and usually associated with the Brigalow is the Beelah (*Casuarina lepidophloia*).

Plate 54.

Mulga (*Acacia aneura*) scrub with an undergrowth of Turkey Bush (*Eremophila Goodwinii*), between Bollon and Cunnamulla, South-West Queensland.

[*Photo. by S. L. Everist.*

Associated with the various species of Wattles and Beelah are other trees such as the Wilga (*Geijera parviflora*), Emu Apple or Gruie (*Owenia acidula*), Mustard tree (*Apophyllum anomalum*), Supple Jack (*Ventilago*), Native Pomegranate or Bumbil tree (*Capparis Mitchellii* and other species), Whitewood (*Atalaya hemiglauca*), Western Rosewood (*Heterodendron oleæfolium*), Western Lime (*Eremocitrus*), &c. A remarkable feature about many of the Western trees is the high fodder value of their leaves, cattle being carried over long periods of drought on " scrub " feed.

[CONCLUDED.]

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Chloris Grasses in Queensland

S. L. EVERIST, Assistant to Botanist.

PART III.*

THE RHODES GRASS GROUP.

THE four species dealt with in this part belong to what we may term "the Rhodes Grass group." They all bear a resemblance to the well-known Rhodes Grass, and are characterised by the presence of a large number of branches in the seed-head, vigorous leaf growth, and a tendency to spread by means of surface runners.

PURPLE TOP GRASS (*Chloris barbata*).

Botanical Name.—*Barbata,* from Latin *barbatus*—bearded, referring to the hairs on the spikelets.

Common Name.—The names Purple Top Grass and Purple Top Rhodes Grass have been applied to this grass. Purple Top Grass is shorter and aptly describes the plant.

Botanical Description.—Stoloniferous perennial; stolons flattened, stout and fairly long. Shoots flattened. Culms erect or geniculated at the base, flattened and striate, unbranched or sparingly branched from the lowermost nodes. Nodes and internodes glabrous. Leaves distichous, green. Leaf sheaths glabrous, striate, flattened and strongly keeled. Auricles small, with tufts of long white hairs. Ligule a small ciliolate rim. Collar small and inconspicuous, glabrous. Leaf blades up to 20 cm. long, folded and strongly keeled; 5 cm. broad at the base, tapering to a fine point; base of blade with a few scattered long hairs on the upper surface. Flowering culms erect. Spikes 5-20, usually 9-16, fasciculate, closely congested and not spreading, up to 8 cm. long, rather weak. Rhachis slender and scaberulous, tomentose at the base. Spikelets very numerous, closely imbricate, subsessile, in two rows on the lower side of the rhachis. Lower glume membranous, lanceolate, acute, 1-nerved, 1·5-1·7 mm. long. Upper glume membranous, elliptic or elliptic-lanceolate, acute or shortly mucronate, 1-nerved, 2·5 mm. long. Lower floret hermaphrodite; lemma firm in texture, obovate in outline, irregularly elliptic in profile, 3-nerved, lateral nerves close to the margins, margins in the upper part long, bearded; lemma 2-2·5 mm. long, folded and bluntly keeled, glabrous on the back except for a tuft of hairs near the middle close to the keel, apex with very short, acute points, awned from the sinus, awn slender, scaberulous, 4-5 mm. long; palea equal in length to the lemma, obovate or almost spathulate, 2-keeled, glabrous, thin in texture; lodicules 2, small, clavate, glabrous; stamens 3; stigmas 2, slender; ovary glabrous; caryopsis pale straw-coloured, shining, elliptic, obtusely triquetrous; embryo large, occupying half the caryopsis. Second floret consisting of an empty lemma only; lemma broadly cuneate in outline, narrowly cuneate in profile, 3-nerved, truncate at the apex, 1·2 mm. long, glabrous or sometimes hairy; awn slender, scaberulous, up to 5 mm. long. Third floret also an empty lemma only; lemma much inflated and almost globose, orbicular in outline, 3-nerved, truncate at the apex and upper edges inrolled, 1 mm. long; awn slender, scaberulous, about 3 mm. long.

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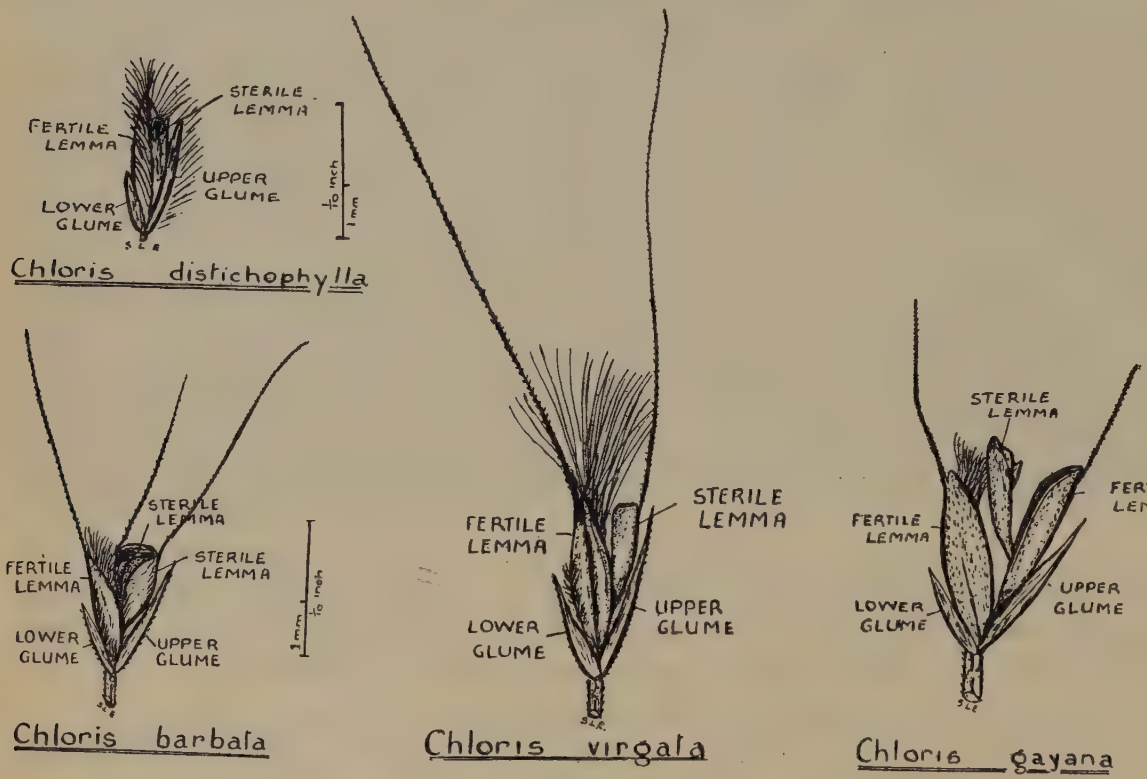
* Part I. of this series was published in May issue, 1935 (Vol. XLIII., page 474, "Queensland Agricultural Journal"), and Part II. in July issue, 1935 (Vol. XLIV., page 18, "Queensland Agricultural Journal").

Popular Description.—A rather robust grass with stout creeping stems, similar in general appearance to Rhodes Grass, but usually somewhat smaller. It is readily distinguished by its purple seed-head and by the smaller spikelets, which are also different in shape.

Distribution.—In Australia, *Chloris barbata* is almost confined to the tropics. Its chief occurrence in Queensland is along the coastal strip from Port Curtis northwards, though it has been found as far west as Julia Creek, on the Great Northern Railway. It also extends to Northern Australia. It is doubtful whether this grass is a native of Australia, as it is a widespread weed in the tropics of both hemispheres.


STERILE LEMMA
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1/10 inch
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Chloris distichophylla
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UPPER GLUME
1/10 inch
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Chloris barbata
FERTILE LEMMA
STERILE LEMMA
LOWER GLUME
UPPER GLUME
Chloris virgata
STERILE LEMMA
FERTILE LEMMA
FERTILE LEMMA
LOWER GLUME
UPPER GLUME
Chloris gayana

Plate 55.

Habitat.—In general, Purple Top Grass favours such situations as roadsides and old cultivation paddocks. It is seldom seen in undisturbed pasture lands.

Fodder Value, &c.—The general opinion concerning the fodder value of this grass seems to be that it is of little consequence. It looks inviting enough, but stock are apparently not at all fond of it. Possibly if the grass were kept short it would be eaten to a greater extent.

Reference.—*Chloris barbata* (Linn.), Sw. Fl. Ind. Occ. 1, 200 (1797).

FEATHER TOP GRASS (*Chloris virgata*).

Botanical Name.—*virgata*, from Latin *virgatus*—made of twigs. This probably refers to the much-branched stems, though it does not seem to be particularly applicable.

Common Name.—In Australia this grass has received a number of names. It was introduced by Col. Sylvester Browne, of Singleton, New

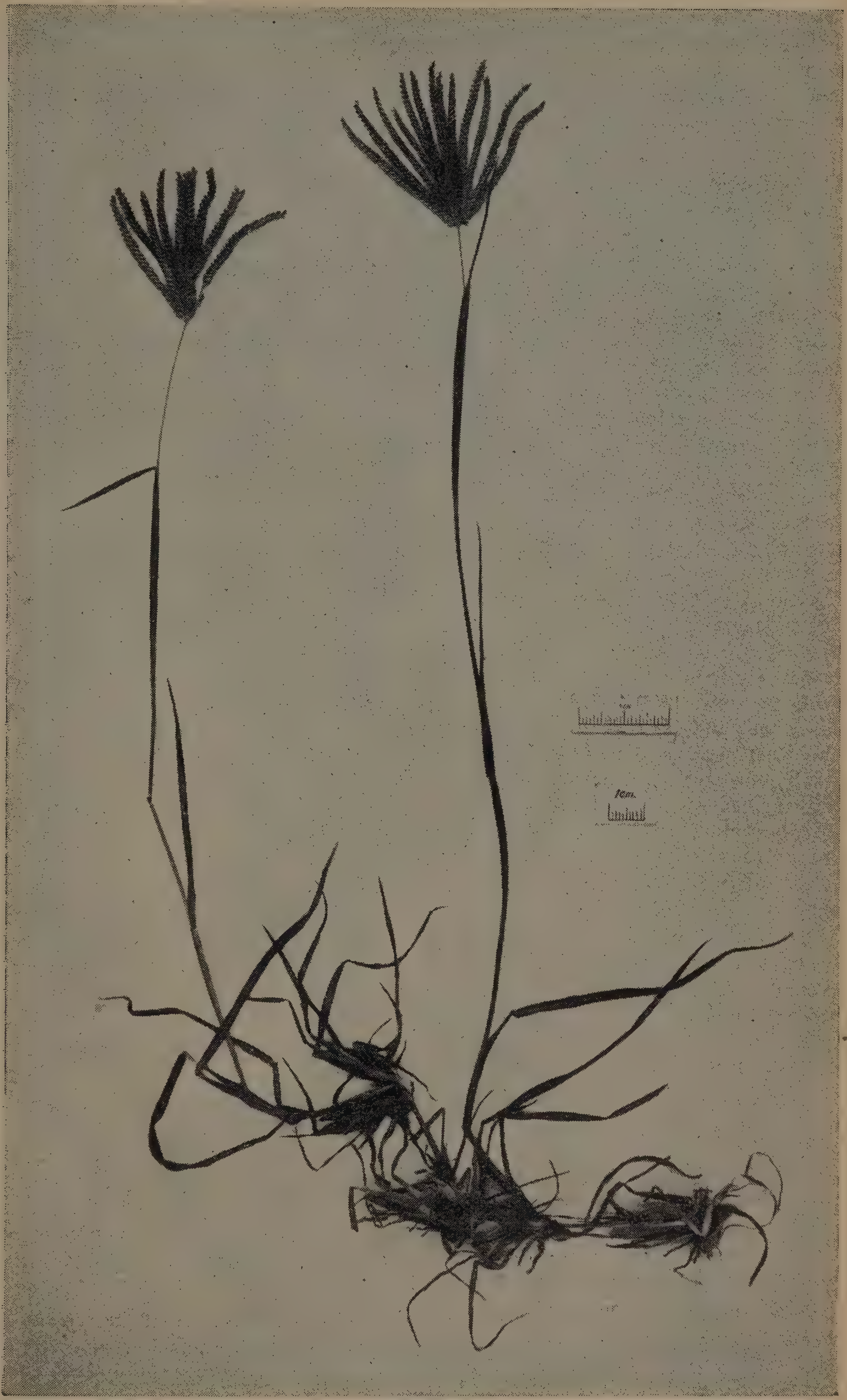


Plate 56.
Purple Top Grass (*Chloris barbata*).

South Wales, along with Rhodes Grass (*Chloris Gayana*), and for a while the two species were not distinguished and both were known as Rhodes Grass. In Queensland, of recent years, it has received the names Native Rhodes Grass, Feather Top Rhodes Grass, and Feathertop Grass. Of these, Feathertop Grass seems to be the best.

Botanical Description.—Annual. Culms decumbent and rooting at the nodes, eventually geniculate, and ascending sometimes up to 120 cm., sometimes less than 15 cm. Culms much-branched and producing leafy shoots at the branched nodes. Nodes and internodes glabrous, internodes exceeding the leaf sheaths, striate and somewhat flattened. Shoots flattened. Leaves distichous, green or straw-coloured when old. Leaf sheaths flattened, keeled tight in the lower part, looser and slipping away from the culm above, glabrous and striate or slightly hairy. Auricles usually with a tuft of long white hairs, which sometimes disappear as the grass grows older. Ligule reduced to a ciliolate rim. Collar narrow and inconspicuous, glabrous. Leaf blades folded in the bud, strongly keeled, even when mature, up to 50 cm. long, usually about 20 cm. when fully developed; the blades with a few long tubercle-based white hairs near the edge on the upper surface, about 5 cm. broad at the base, tapering to a fine point. Flowering culms erect or obliquely ascending, the uppermost leaf sheath enclosing the inflorescence until maturity, when the spikes are exserted. Spikes digitate, 6-14, usually about 12, closely clustered, not spreading, 3-9 cm. long. Rhachis slender, triquetrous, densely but shortly hairy at the base, scabrous or shortly ciliate for most of its length. Spikelets sessile or subsessile, closely imbricate in two rows on one side of the rhachis. Lower glume 1-nerved, membranous, lanceolate, acute, up to 2 mm. long. Upper glume 1-nerved, membranous, narrowly oblong or elliptic, folded and keeled, the keel scabrous and produced into a 0·6-1 mm. long awn or mucro from the bifid apex of the 2·5-3 mm. long glume. Lower floret hermaphrodite; lemma 3-nerved, firm in texture, usually pale-coloured, but occasionally almost black when ripe; broadly elliptic in outline, irregularly elliptic in profile, folded and bluntly keeled, and with a longitudinal groove in the middle of each face, 2·5-3 mm. long. Edges shortly ciliate in the lower half, long-bearded near the apex, apex 2-lobed and awned from the cleft, the lateral lobes short, acute; awn scabrous, long, slender, and straight, about 2 cm. long; palea membranous, 2-keeled, almost as long as the lemma, obovate or almost elliptic; lodicules 2, small, cuneate; stamens 3; ovary glabrous; stigmas 2; caryopsis terete or slightly flattened, narrowly elliptic, up to 2 mm. long, surface brown, smooth, and shining.

Popular Description.—An annual grass, the stems of which spread out along the ground and root at the joints before growing upright. It sometimes grows up to 4 feet high, and occasionally flowers when less than 6 inches high. The leaves are long, green, and folded; the shoots are flattened. The seed-head consists of numerous fluffy white spikes at the top of a short stalk. When young, the spikes are enclosed within the uppermost leaf. The "seeds" or spikelets are pale in colour, and bear tufts of long hairs and two long, slender awns.

Distribution.—*Chloris virgata* is a common tropical and subtropical weed widely spread over both hemispheres. In Queensland it is widely distributed, and has been recorded from all districts except the far south-west and centre. It is particularly abundant on the coastal and downs country.

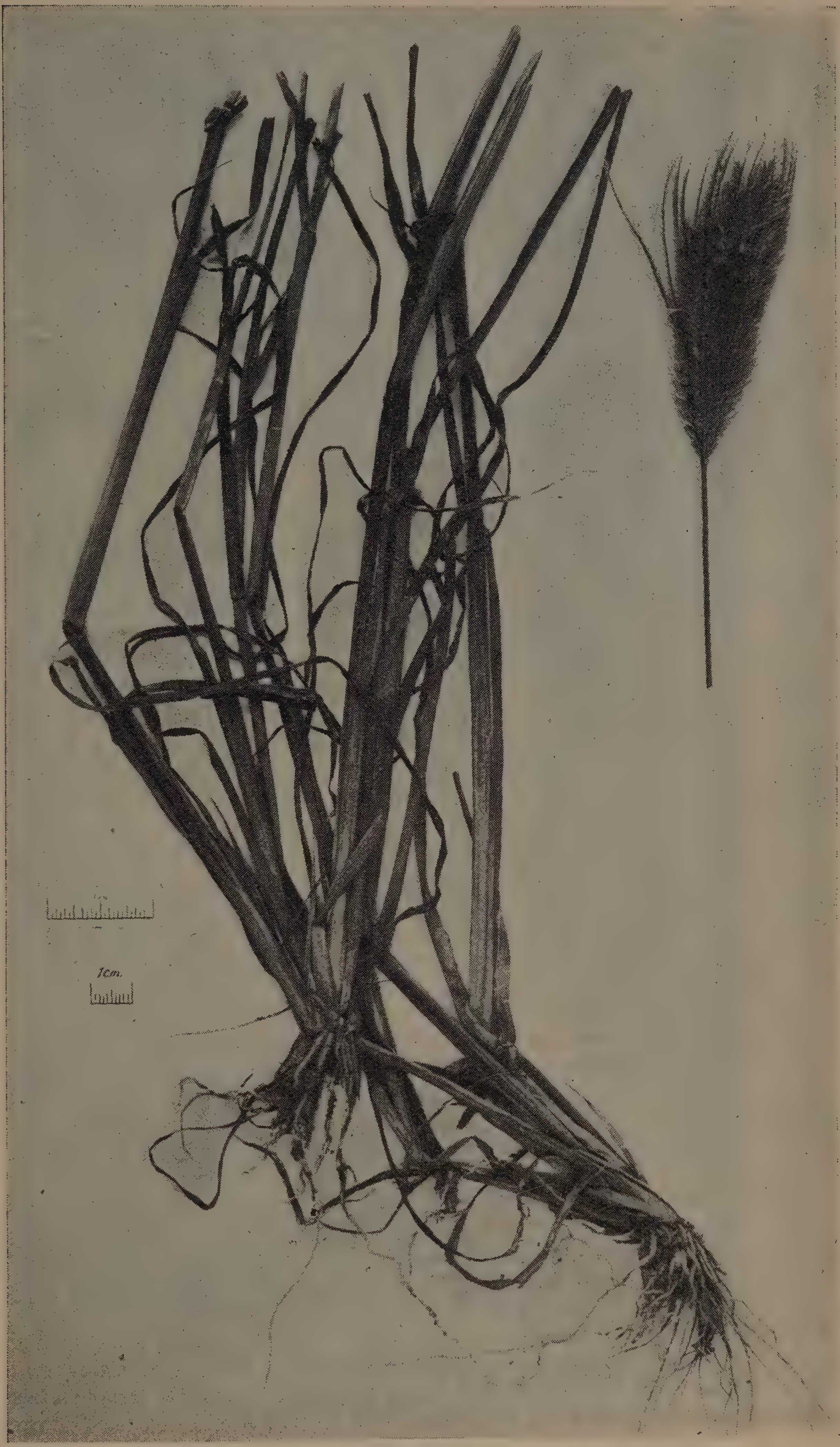


Plate 57.
Feather Top Grass (*Chloris virgata*).

Habitat.—*Chloris virgata* is a common weed of cultivations, particularly lucerne paddocks, and it is frequently found along roadsides.

Fodder Value, &c.—Conflicting reports have been received at various times concerning the fodder value of Feathertop Grass. Most of them indicate that although the grass looks tempting enough, stock will not eat it when other feed is available. Others state that it is liked by stock in all stages of growth, and others again that stock will eat it when made into hay. The general consensus of opinion seems to be that its presence is undesirable, since better grasses will usually thrive in the same situations.

Reference.—*Chloris virgata,* Sw. Fl. Ind. Occ. 1, 203 (1797).

RHODES GRASS (*Chloris Gayana*).

Botanical Name.—*Gayana,* apparently named after a Mr. Gay. I can find no record of the exact person to whom it refers.

Common Name.—In Australia this grass is known everywhere as Rhodes Grass.

Botanical Description.—Annual or perennial; in Australia usually a perennial up to 120 cm. high. Culms procumbent, branched, often rooting at the lower nodes and emitting fascicles of leaves. Leaves green, distichous. Leaf sheaths glabrous, striate, flattened and keeled, lower ones about as long as the internodes, upper ones comparatively shorter. Auricles small and inconspicuous, long-bearded or becoming glabrous with age. Ligule small, membranous, the edges ciliolate. Collar glabrous. Base of leaf blade immediately above the ligule densely covered with long, tubercle-based, white hairs. Leaf blade long, folded or flattened, acutely keeled, 3-5 mm. broad at the base, tapering to a fine point; glabrous except for the upper surface near the base and occasional long hairs along the edges, edges scabrous. Flowering culms erect, short. Spikes digitate, 7-17, usually 12-15 in number, obliquely erect when young, ultimately more or less horizontally spreading or sometimes slightly reflexed. Rhachis of each spike slender, shortly but densely tomentose at the base, scabrous or shortly ciliate for most of its length. Spikelets sessile, very numerous and closely imbricate in two even rows on one side of each rhachis. Spikelets with two hermaphrodite florets and one or two male florets above them, though sometimes there is merely an empty lemma above them. Rhachilla prolonged and frequently bearing a very much reduced empty lemma. Lower glume elliptic or ovate-elliptic, obtuse or shortly acute, 1-nerved and strongly keeled, up to 2 mm. long. Keel scabrous or shortly ciliate. Upper glume 3-3·5 mm. long, elliptic in outline, rather thin in texture, pale-brown in colour except for the thin transparent membranous margins, the edges of the brown portion with a fringe of long hairs in the lower part; glume 1-nerved and strongly keeled, the middle nerve prolonged into a short mucro, keel scabrous; apex of the glume acute or bifid. Lowest floret hermaphrodite, lemma 3·2-3·5 mm. long, firm in texture, broadly elliptic in outline, irregularly rhomboidal in profile, glabrous, folded and bluntly keeled, with a longitudinal groove in the middle of each face; 3-nerved, lateral nerves very close to the margins; margins ciliate in the lower half, long-bearded toward the apex; apex bifid with a short awn from the sinus; awn up to 7 mm. long, base of the

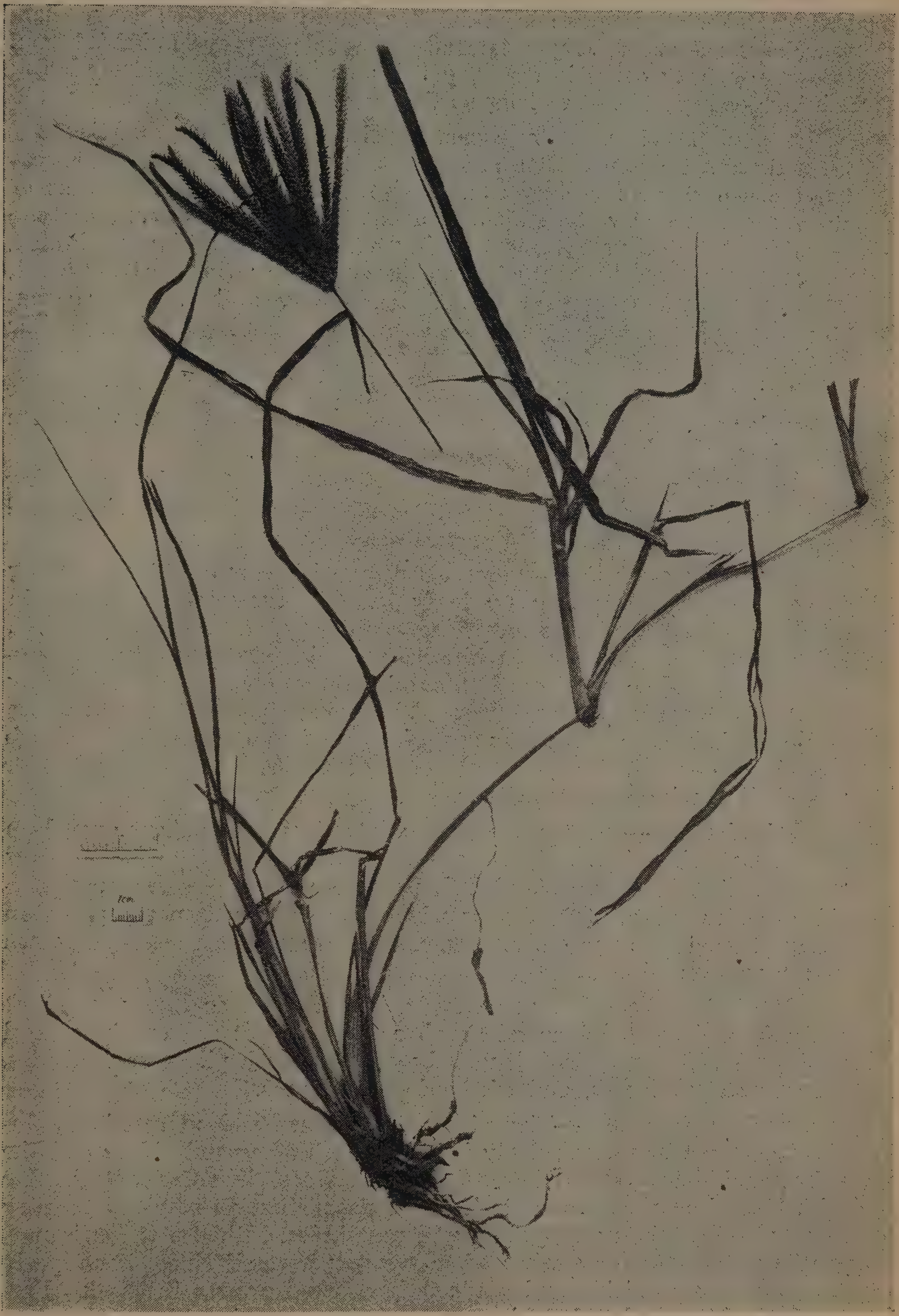


Plate 58.
Rhodes Grass (*Chloris Gayana*).

lemma with a ring of long hairs; palea as long as the lemma, thin in texture, 2-keeled, elliptic; lodicules 2, minute; stamens 3; ovary glabrous; styles 3, short; stigma laterally exserted; caryopsis about 1 mm. long, irregularly ovoid in shape, pale-brown in colour, dull or slightly shining; embryo almost as long as the caryopsis.

Second floret usually hermaphrodite. Sometimes, particularly when there are two male florets above it, it is identical with the lowest floret except for its slightly smaller size and the glabrous margins of the lemma. Usually the lemma is about 2 mm. long, obovate-cuneate in outline, narrowly oblong cuneate in profile, folded and bluntly keeled, 3-nerved, the lateral nerves close to the margins; apex shortly 2-lobed, with a short awn from the sinus. Palea as long as the lemma, spathulate, 2-keeled, glabrous. Lodicules, andræcium, and gynæcium similar to those of the lower floret, but smaller in size.

Third floret usually male, sometimes reduced to a broadly cuneate empty lemma. If male, it resembles the second lemma, but without a gynæcium.

Fourth floret, if present, sometimes male, but usually consisting of a small, broadly cuneate lemma. If male, it is similar in shape and structure to the third floret, but much smaller.

Popular Description.—Vigorous grass with running stems rooting at the joints and sending up leafy shoots. Leaves bright-green in colour, long and slender and tapering to a fine point. Usually free from hair except for a number of white hairs at the base on the upper surface. Seed-heads consisting of an erect stalk surmounted at the top by about 12-15 spreading branches. When young, these branches are erect; as they grow older they spread out and sometimes droop. Each branch bears upon the lower surface two rows of brown spikelets or " seeds " bearing 2 or 3 bristles.

Distribution.—Rhodes Grass was introduced into Australia from Africa by Col. Sylvester Browne, who first grew it at Singleton, New South Wales. In Queensland it is now extensively planted upon hillsides and in sub-coastal country where Paspalum will not thrive. In many places it has run out and become naturalised. It has been grown as far west as Winton.

Habitat.—Rhodes Grass grows best on alluvial or loamy soils, but will also thrive on lighter soils such as are encountered on the coastal ridges. When naturalised, it usually grows in such places as roadsides, railway embankments, and cultivation headlands.

Fodder Value, &c.—There is no doubt that Rhodes Grass is a valuable pasture grass, particularly in places such as coastal ridges and the sub-coastal dairying districts. It is useful also in rotational grazing with Paspalum pastures, and allows of the utilisation of ridgy country upon which ordinary Paspalum will not thrive. Rhodes Grass is particularly suitable for sowing after scrub " burns," since, if properly sown, it covers quickly and tends to keep weed growth in check. Particulars of methods of sowing and grazing are given in a pamphlet issued by the Department of Agriculture and Stock.

Reference.—*Chloris Gayana* Kunth., Rev. Gram. i. 89, ii. 293, t. 58 (1829).

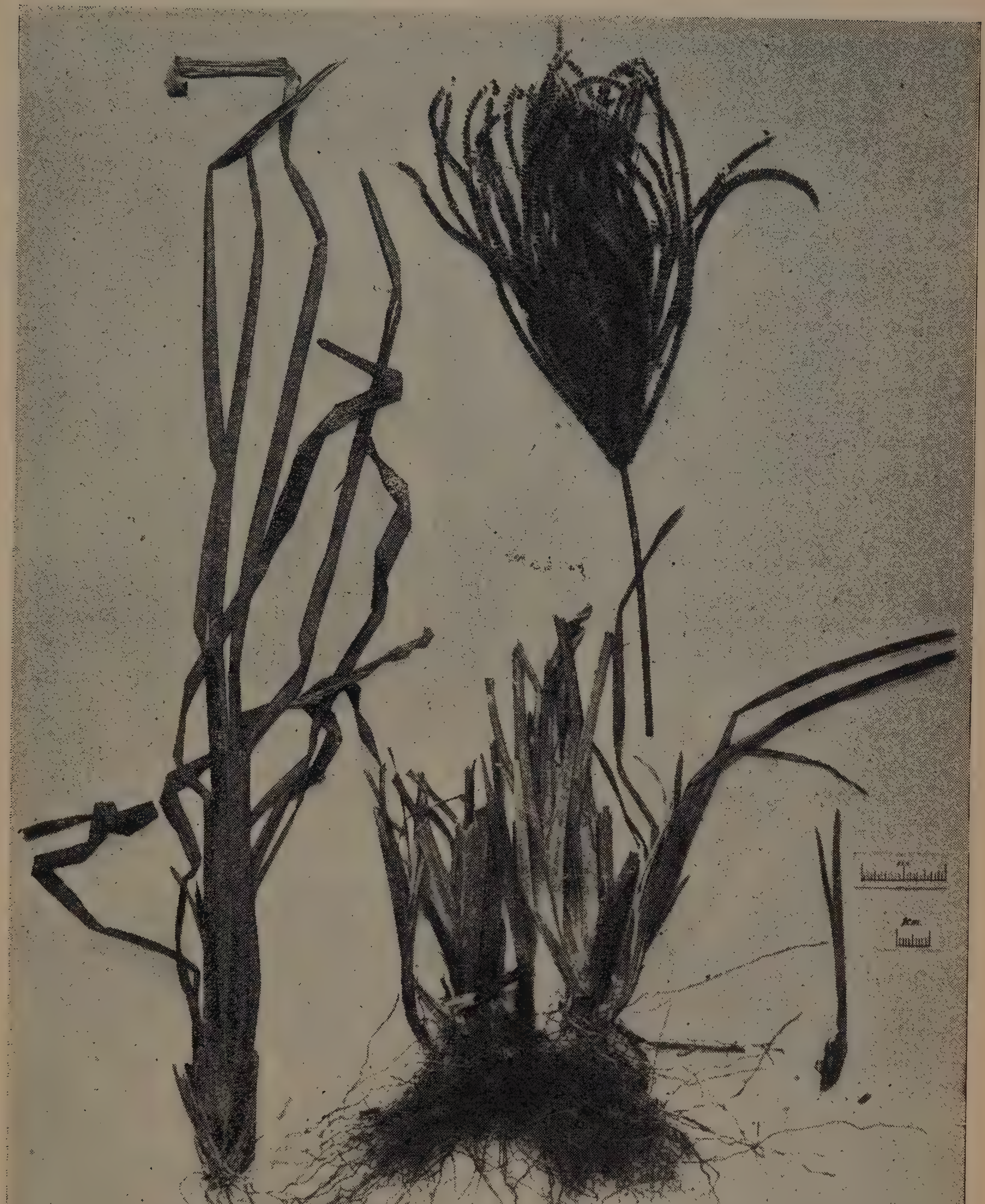


Plate 59.
Evergreen Chloris (*Chloris distichophylla*).

EVERGREEN CHLORIS (*Chloris distichophylla*).

Botanical Name.—*distichophylla,* from Greek *distichos* (of two rows), and *phyllon* (a leaf), referring to the leaves being arranged in two opposite rows.

Common Name.—Several common names have been proposed for this grass, including Evergreen Chloris, Frost-resistant Rhodes Grass, and Winter-growing Rhodes Grass. It seems desirable to restrict the name Rhodes Grass to *Chloris Gayana* (see above). Evergreen Chloris is quite appropriate.

Botanical Description.—Tufted perennial; rhizomes short and stout, much-branched and producing numerous shoots from the upper side; majority of the shoots produced upon the outside of the clumps, a few within the clumps. Young shoots flattened. Leaves conspicuously distichous; leaf sheaths glabrous, scaberulous, striate, broad, rigid, flattened and sharply keeled, purplish at the base, green in the upper part, 5-20 cm. long; ligule reduced to a short membranous ring with minutely ciliate margin; leaf blades up to 50 cm. long, 7 mm. broad in the middle, tapering slightly towards the base, apex rounded, obtuse, margins scaberulous; blade with a prominent midrib, usually folded throughout its length, becoming flattened when old. Flowering culms erect, few-noded, up to 1 m. high, branches numerous, up to 45 in number and about 15 cm. long, slender, weak, semi-erect when young, drooping when mature; rhachis of the spikes slender, triquetrous, scaberulous above, shortly ciliate on the lower side. Spikelets small, numerous, closely imbricate in two rows on the lower side of the rhachis, 2-flowered. Glumes thin, membranous, pale straw-coloured; lower glume 1-nerved, 1·5 mm. long; lanceolate, acute; upper glume 1-nerved, up to 2·2 mm. long, elliptic-lanceolate, mucronate or shortly aristulate, point always shorter than 0·5 mm., lateral margins inrolled. Lower floret hermaphrodite; lemma usually dark-brown at maturity and thinly cartilaginous in texture, 2·5 mm. long, ovate-elliptic in outline, not or scarcely laterally compressed, rounded dorsally and with a shallow groove on each side, 3-nerved, the lateral nerves marginal, the middle nerve produced into a short blunt point; margins beset with a close fringe of long white hairs; palea almost as long as the lemma, somewhat thinner in texture, but of the same colour, 2-nerved, sharply 2-keeled, keels minutely ciliate; inrolled edges thinly hyaline in texture; lodicules flat, broadly cuneate, 0·1-0·2 mm. long; stamens 3, filaments slender, anthers broadly linear, slightly shorter than the filaments; stigmas 2, plumose; caryopsis dark-brown when ripe, slightly shining, ovoid in outline, plano-convex or almost triquetrous in cross-section, 1 mm. long, 0·5 mm. broad; embryo about half as long as the caryopsis. Sterile floret reduced to a lemma, thinly cartilaginous in texture, not compressed, not keeled, rounded on the back, somewhat inrolled at the tip, up to 1·5 mm. long, very broadly cuneate in outline, narrowly cuneate or semi-elliptical in profile, 3-nerved, the lateral nerves near the margins better developed than the middle nerve, which vanishes before reaching the apex; lemma awnless, apex inrolled, obtuse.

Popular Description.—Grass forming dense, leafy tufts sending up long seed stalks with numerous radiating branches at the top. Young shoots very flat, purplish at the base; leaves long, stiff, and usually folded throughout their length. Seed stalks bearing numerous brown "seeds" or spikelets, each with a fringe of long white hairs.

Distribution.—Evergreen Chloris is a native of South America. It has been naturalised in Queensland for a very long time, but has never shown any tendency to spread. In Queensland it is naturalised chiefly in the Moreton and Wide Bay districts, though it is now cultivated in many parts of the State.

Habitat.—The grass, when naturalised, is usually found in waste places, on roadsides and embankments and other places where the ground has been disturbed. It is usually cultivated on soils similar to those suitable for Rhodes Grass.

Fodder Value, &c.—Until recently, little notice was taken of this grass from a grazing point of view. Of late years considerable attention has been paid to it because of its frost-resistant qualities. The grass is said to be palatable to stock and quite nutritious. However, tests made by the Agricultural Chemist indicate that Evergreen Chloris contains a prussic-acid-yielding glucoside. Because of this it would be wise to exercise care in feeding the grass to stock. Apart from its economic importance as a fodder, the grass is of value for ornamental purposes.

Reference.—Chloris distichophylla, Lagasca Gen. et Spec. Nov. 4 (1816).

[TO BE CONTINUED.]

TABLE OF UTERO-GESTATION.

Animal.	Average Period.	Early Period for Young to Live.	Late Period.
Mares	335-345 days (11-11⅓ months)	307 days (10 months)	365 days (12 months)
Cows	275-287 days (39-41 weeks)	242 days (34½ weeks)	312 days (44½ weeks)
Sheep and Goats	149-151 days (21-21½ weeks)	140 days (20 weeks)	160 days (23 weeks)
Sows	112-119 days (16-17 weeks)	105 days (15 weeks)	126 days (18 weeks)
Bitches	63 days (9 weeks)	55 days (8 weeks)	70 days (10 weeks)
Cats	55 days (8 weeks)	50 days	64 days
Rabbits	28-30 days (4 weeks)	..	..

The Estimated Age of Some Queensland Trees.

W. D. FRANCIS, Assistant Government Botanist.

Introductory Remarks.

IN parts of the Northern Hemisphere, such as Europe and North America, it is well known that many kinds of trees produce annual rings in their wood. These annual rings are so well marked that the age of many trees can be accurately computed from them. Annual rings are especially well developed in Pine trees and their allies. A very large amount of work has been done on the Big Trees (*Sequoia gigantea*) of North America. These trees have special features which facilitate investigation. They are very large trees, and their wood rings are conspicuous when the stems are sawn or cut across. The writer saw a section of one of these very large trees which is exhibited in the Natural History Section of the British Museum in London.

The American investigators have calculated the ages of some of the specimens of the Big Tree and found that in some cases the trees were living 1,000 years B.C. In addition, some of the American investigators have used the growth rings of these trees as indicators of the climate of the past. These fascinating studies of the gigantic American trees have led some Queensland residents to hope that some of our trees may provide data of the climate of the past.

Queensland Studies.

About nine years ago the writer undertook a preliminary study of the growth rings in some native coniferous trees of this State. The purpose of the study was chiefly anatomical. It was also considered desirable to find out if our coniferous trees formed annual rings. A brief account of this work will be given in this article. In addition some observations made since will be outlined.

Cross sections of stems of the Hoop Pine (*Araucaria Cunninghamii*), Bunya Pine (*Araucaria Bidwillii*), and Queensland Kauri Pine (*Agathis robusta*) were prepared and examined. Fine microtome sections of the wood of these trees were also prepared and photographed under the microscope. It was found that there are growth rings in the trees examined. But it was soon realised that the growth rings are not so well marked and are not nearly so regular as those of European and North American trees. This result is not surprising in view of the character of our climate in comparison with the climate of Europe and North America. The regular yearly occurrence of low temperatures in which plant growth is suspended is characteristic of the North European and North American environment. These conditions obviously do not occur in Queensland—at least in the areas where the trees which were investigated by the writer grow.

Microscopic Features of Growth Rings.

Apart from their less regular and distinctive character, the growth rings of the trees investigated do not differ microscopically from those of Europe and North America. The principal features of growth rings in the microscopic view are the size of the internal cavity of the wood cells and the thickness of the walls of the cells. In the outer or dark-brown portion of the growth ring, which is formed in the autumn or late summer, the internal cavity of the wood cells is smaller and the walls of the wood cells are thicker than those of the cells in the part of the ring formed in the spring or early summer.

In studying wood rings it is essential to distinguish between rings constituted as just described and the fine zones of soft tissue (or wood parenchyma) which are found in the wood of many trees, such as the Rosewood (*Dysoxylum Fraseranum*), Red Bean (*Dysoxylum Muelleri*), and Moreton Bay Fig (*Ficus macrophylla*). These are native trees.

Annual Rings in Queensland Trees.

The growth of rings of the Hoop Pine, Bunya Pine, and Queensland Kauri Pine consist of two portions which are distinguishable to the eye by their colours. The lighter-coloured portion corresponds to the spring or early summer wood. The darker portion, mostly dark-brown in colour, corresponds to the autumn or late summer wood. The writer observed that the boundaries of the growth rings are more sharply defined in mature or old trees than in young, quickly growing trees.

It was definitely established that two or perhaps more rings are sometimes formed in one year in the Queensland trees examined. On the other hand, there were fairly definite indications that in the Hoop Pine there were varying numbers of rings, each of which was produced in a single year. These could be called annual rings. They are characterised by their comparative uniformity and their occurrence in connected series of two or more rings.

Method of Estimating the Age of Queensland Trees.

The writer suggested that these comparatively uniform rings, which are apparently annual, could be used to estimate the age of a tree in which they occur. These apparently annual rings can be measured throughout the section of the stem and the average width of them calculated. The measured radius (or half-diameter of the stem) when divided by the average width of the apparent annual rings gives an estimated age for the tree.

Results of Estimating Age of Queensland Trees.

Using this method, the writer estimated the age of a Hoop Pine tree which was growing in the Gympie district. This tree was 117 feet (35 m.) in total height, and had a stem diameter of 21 inches (53 cm.). Its age was estimated at 135 years. The age of a Kauri Pine tree which grew in the Kin Kin district was estimated in the same way. This tree measured 120 feet (36 m.) in total height, and had a stem diameter of 54 inches (135 cm.). Its age was estimated to be 228 years. In this case, however, only the outer part of the section of the stem was available, and consequently the data for estimation were meagre. Some of the larger Kauri Pines which grew in the same district attained a height of 160 feet (48 m.), and a stem diameter of 8 feet (240 cm.). If these larger trees grew at the same rate as the one from which the partial section was taken, their age could be estimated at about 400 years.

Applying the same method, the age of a large Eucalypt, which is lying on the ground at Eagle Heights, Tambourine Mountain, was estimated. This tree presumably was a Flooded Gum (*Eucalyptus saligna*). It was apparently well over 120 feet (36 m.) in height and about 6 feet (180 cm.) in stem diameter. The age of this tree was estimated as between 150 and 200 years. Large Flooded Gum trees are a feature of the landscape of Tambourine Mountain. These trees have large, smooth, pale, column-like stems. At first sight the age of 150-200 years seems slight in comparison with their size and impressiveness. But the writer is convinced from observations of the growth of young trees of the species that this Eucalypt is an extremely fast grower.

The Reputed Age of other Queensland Trees and Plants.

Botanists are frequently asked about the age of the Antarctic Beech (*Nothofagus Moorei*). This species is confined to the mountain ranges of extreme South-eastern Queensland and the highlands of Northern New South Wales. The writer has no knowledge of any investigations which indicate even approximately the age of these trees. In many cases it would be difficult to form any idea of the age of these trees. The stems frequently branch out from a common base. The older stems die out. This produces a complicated position which is not met with in the usual case. Trees usually produce only one stem, and this persists from the beginning of the life of the tree.

The recent destruction of the large Cycad (*Macrozamia Denisonii*) on Tambourine Mountain has aroused interest in the age of these plants. It has been stated that the large specimen which was cut down was estimated to be 15,000 years old. The authority for this estimate is not known to the writer. Judging from Professor C. J. Chamberlain's statement in his book, " The Living Cycads," the procedure for estimating the age of a Cycad is scarcely so trustworthy as the annual ring method applicable to some trees. In the case of Cycads, observations extending over a period of years are necessary. In this periodic observation the number of leaves formed in a single year is ascertained. Next the leaf bases on the trunk of the Cycad are counted. The number of the leaf bases is then divided by the average number of leaves formed in a year. The result of this division gives the estimated age of the Cycad. Up to the present the writer is not aware if this procedure has been carried through on Tambourine Mountain.

Conclusion.

It is regretted that the investigations, so far as they have been prosecuted, do not provide any substantial basis for interpreting the climate of the past. It is realised that meteorologists and those who are concerned with the development of weather-forecasting would be materially assisted if native trees formed more regular rings. It is as well to remark, however, that the subject is still open for further investigation.

Photographs and photomicrographs of some of the sections of stems investigated in the earlier work are given in the places cited in the references below.

REFERENCES.

Francis, W. D.: The Growth Rings in the Wood of Australian Araucarian Conifers. Proc. Linn. Soc. N.S.W., Vol. 53, p. 71, 1928.

Francis, W. D.: Australian Rain-forest Trees. Pages 52-54, 1929.

Agricultural Notes

Scattered storm rains have fallen over a wide area of the State, but up to the time of writing no soaking general rains have been received, and owing to the dry subsoil, the rains registered can only be regarded as giving temporary relief. Conditions are somewhat more favourable in the North-West, Atherton Tableland, Calen, Granite Belt, and South-West tobacco lands, but the main agricultural areas from Bundaberg to the Border are still in need of seasonal rains. The recent heat wave has also affected the position adversely, rapidly drying out the young green pastures and summer crops that had become established after the early January rains. Fortunately, water supplies in creeks, tanks, and dams have to some extent been replenished.

Fodder Crops.

A large area has been sown with various summer crops in an endeavour to provide for immediate requirements, and to supplement reserves depleted during the prolonged dry spell. Where conditions are suitable, the provision of early winter feed should now be receiving attention. The more popular varieties of sweet sorghum, such as saccaline, imphee, and white African are quite suitable for this purpose, particularly in the coastal areas where heavy frosts are not experienced. February sowings will provide a large bulk of palatable and nutritious fodder, which may be cut as required or utilised as silage. Unlike maize, which dries out rapidly after reaching maturity, the sorghums retain their succulence for a considerable time, even after light frosts have checked growth. Drilling the seed in rows approximately 3 feet apart is recommended in preference to broadcasting.

Millets, such as Japanese, white panicum, giant setaria (or giant panicum), and dwarf setaria (Hungarian or liberty millet), may also be sown during the present month, and are recommended where an early maturing crop is desired.

Potatoes.

The autumn crop usually planted during February produces heavier yields than the early or spring crop, and provides the bulk of the State's expanding production of this commodity. Owing to the partial failure of the early crop many growers will be obliged to purchase seed potatoes at the prevailing high rates, a factor which may reduce the area ultimately planted. The use of sound seed and the rotation of crops are important factors in the control of Irish Blight, but the principal control is effected by the maintenance of a protective covering of Bordeaux spray solution. Seed treatment with the formalin solution is also advised, full particulars of which are obtainable on application to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Tobacco.

Weather conditions in the State during the past six months have been very unfavourable for the tobacco crop, and in many districts the period under review was one of the driest on record. Good rains during December and early January relieved the position, proving most favourable to the growth of the early crops, and to the fertilization and planting of the late crops. Present indications are that the area planted will represent an increase over that for the past season.

It is estimated that of Queensland's 1935-36 tobacco crop (approximating 2,000,000 lb.) at least 90 per cent. was sold at auction sales, and growers generally have expressed satisfaction with the values received. The new import duties imposed by the Commonwealth Government have had the effect of causing additional buyers to operate, thus creating greater opposition and brisker bidding.

Sugar.

Highly favourable growing conditions prevailed in all cane areas from Mackay north, during the month of January.

The Southern districts have received further scattered rains, and although the crop is making slow progress, it is decidedly backward; soaking rains are urgently needed to stimulate vigorous growth.

Cotton.

The cotton crops have made fairly satisfactory progress during the month. Late December rains were sufficient to promote good growth of plants in the earlier sowings and provide a nice start for subsequent plantings. Dry weather ruling through most of January steadied all growth, however, which has resulted in nicely developed crop prospects in most districts. Good rains are now required to assist the plants in further crop production.

The plantings as a whole have been free from serious insect attack. If favourable conditions occur from now on it is possible that any delay in planting will be largely overcome, with a resultant satisfactory crop production.

USES OF SODIUM SILICATE ON THE FARM.

Sodium silicate, under the name of waterglass, is well known on farms as an egg preserver. In its different forms it has a variety of uses.

A hot one per cent. solution (1 lb. to 10 gallons) of alkaline sodium silicate is a powerful detergent, and is consequently used widely in cleansing floors, utensils, cream cans, bottles, &c. It is also used to remove grease and dirt from clothes.

Colloidal sodium silicate is used in proofing casks and rendering concrete floors, feeding troughs, holding tanks, &c., resistant to the acids that arise from bacterial action on fats, molasses and other fermentable substances.

Timber and fabrics may be impregnated with sodium silicate to render them fire proof. The solution is capable of acting as a vehicle for pigments and fillers so that two jobs may be done at once.

The Department of Agriculture and Stock will arrange for any enquiries on this subject to receive prompt attention.—Dr. M. White.

The Dairy Farm

ECONOMY IN DAIRY PRODUCTION.

G. H. E. HEERS, Director of Dairying.

A MEASURE of economy which involves the dairy farmer in very little extra work is to increase production by systematic herd testing and culling, and breeding only from the best producers.

Far too many herds include cows whose production falls far below average, and the dairy would be run far more economically if these cows were fattened for the butcher. They belong to the "boarder" class, and usually consume more fodder than a heavy producer. Too many animals of this class impair the efficiency of the farm.

No matter how close a watch is kept, it is almost impossible to pick the lowest producers without systematic testing over the whole lactation period. If the farmer is prepared to do this himself well and good, but he requires to have an accurate knowledge of testing and the principles involved in calculating results.

The Department of Agriculture and Stock offers a herd-testing service which involves the dairyman in no monetary expenditure whatsoever. In other States and countries up to 6s. per cow is paid for a similar service. Surely it is impossible to believe that dairy farmers in other parts pay for something that is valueless.

In Queensland many dairymen have availed themselves of the services offered, and the results achieved by those who have tested and culled over a number of years have proved that it is well worth while. Nevertheless, there are very many more who could do so to their own advantage.

To obtain this service it is only necessary to make application to the Department. Sample bottles in a box are sent to the farmer, and all he has to do is to weigh each cow's milk and place a sample in a bottle, as directed. Then, if the factory he supplies is co-operating with the Department, he forwards the box of bottles containing the samples to that factory. Otherwise he may send his samples direct to the Department of Agriculture and Stock, which pays the rail freight.

The testing is done five times at intervals of, approximately, sixty days, and at the end of the period the farmer receives a complete return showing the relative value of each cow under test. It must be remembered that the object of testing is not so much to find out the best cows in the herd as to find out the worst and least profitable.

Testing is only half the job, and the Department depends on the good sense of the farmer to see that he does not keep feeding unprofitable cows indefinitely. Testing is of no value in raising the standard of production of the herd unless the low producers are culled regularly.

It is a poor farm that cannot afford to dispose of the two least profitable cows each year. Remember the first loss is the least. The longer the "boarders" are kept the more expensive they become. They eat the feed of a good milker and much time is wasted, frequently, in rearing their calves, which turn out no better producers than the dams.

UNPROFITABLE COWS.

L. VERNEY, Instructor in Dairying.

ONE has heard the subject of marginal and submarginal profits and marginal and submarginal land discussed frequently. Marginal land may be described as land that returns about enough to pay its way. The return from submarginal land, however, is less than that.

Applying these terms to dairy cows, the records show that dairymen are feeding and milking many marginal and submarginal cows; in other words, cows which barely pay their way and those which are actually milked at a loss. The owner of submarginal land is a slave to his land, and the owner of submarginal cows is a slave to his dairy herd. One is land poor and the other is cow poor.

The question might be asked by those concerned: At what production level does a cow become submarginal? That depends on many things. To the man who relies on the family cow for milk and butter for his family, there may be no apparent marginal production level; but to the man who owns and milks a dairy herd for his livelihood the marginal production level should be comparatively high. Even for the commercial dairy herd, the marginal production level is not constant. It varies much from time to time and from place to place. It is influenced by cost of feed and labour, by price of product (butterfat), and by the distance from the manufacturing centre; yet in a general way each dairy farmer should establish a production level, or a standard below which no cow in his herd can fall and still remain in the herd. On the average the dairy cows in this State produce yearly about 2,500 lb. milk, containing 125 lb. butterfat. That being the average, it may safely be assumed that one-half of the dairy cows of this State produce less than that. Do these cows produce a profit? Do they earn enough to pay for labour and overhead expenses? Can it be true that half our dairy cows are submarginal? The answers can only be given by dairy farmers. In some of our pure-bred herds there are cows that are certainly producing quantities very much in excess of the figures quoted.

A very earnest endeavour must be made to raise our standards by a comprehensive system of herd testing. It behoves all connected with dairying to give more serious thought to this aspect of the industry.

It must be acknowledged that unless this great industry is built on a sound basis all the system and efficiency methods which may from time to time be introduced will never give it the stability so necessary to make it what it should be, not only to the State, but to every individual dairy farmer. The ultimate success of dairying depends largely on a satisfactory production per cow being established throughout the State. So let the dairyman's slogan be "Breed from the best and cull the rest."

AGRICULTURE ON THE AIR.

RADIO LECTURES ON RURAL SUBJECTS.

Arrangements have been completed with the Australian Broadcasting Commission for the regular delivery of further radio lectures from Station 4QG, Brisbane, by Officers of the Department of Agriculture and Stock.

On Friday of each week a fifteen minutes' talk, commencing at 12.45 p.m., will be given on subjects of especial interest to farmers.

Following is the list of lectures until the 30th April, 1937.

SCHEDULE OF LECTURES.

BY OFFICERS OF THE DEPARTMENT OF AGRICULTURE AND STOCK, RADIO STATION 4QG, BRISBANE (AUSTRALIAN BROADCASTING COMMISSION).

Friday, 5th February, 1937—"The Importance of Type in Queensland Merino Flocks," by J. L. Hodge, Instructor in Sheep and Wool.

Friday, 12th February, 1937—"Fat Lambs in Queensland," by J. L. Hodge, Instructor in Sheep and Wool.

Friday, 19th February, 1937—"Increase your Return from Eggs. How it can be done," by P. Rumball, Poultry Expert.

Friday, 26th February, 1937—"With the Flock in February. Points for the Poultry Farmer," by J. J. McLachlan, Poultry Inspector.

Friday, 5th March, 1937—"The Harvesting of Cotton," by R. W. Peters, Cotton Experimentalist.

Friday, 12th March, 1937—"Plant Nutrition," by E. H. Gurney, Agricultural Chemist.

Friday, 19th March, 1937—"Sheep Management under the Varying Conditions in Queensland," by Jas. Carew, Senior Instructor in Sheep and Wool.

Friday, 26th March, 1937—"The Care of the Flock," by Jas. Carew, Senior Instructor in Sheep and Wool.

Friday, 2nd April, 1937—"Winter Pastures," by C. W. Winders, Assistant (Agronomy).

Friday, 9th April, 1937—"Pork Products as Regular Items on the Menu," by E. J. Shelton, Senior Instructor in Pig Raising.

Friday, 16th April, 1937—"Some Poultry Farmers' Problems. What to Breed and How to Breed," by J. J. McLachlan, Poultry Inspector.

Friday, 23rd April, 1937—"Strawberry Planting and Other Seasonal Fruit Hints," by H. Barnes, Director of Fruit Culture.

Friday, 30th April, 1937—"Wheat Improvement in Queensland," by R. E. Soutter, Agricultural Research Officer.

The PIG FARM

FEEDING BACON PIGS.

E. J. SHELTON, Senior Instructor in Pig Raising.

OWING to conditions associated with the prolonged dry spell of weather in Southern Queensland, and to the fact that the price charged for pig foods of all descriptions is at a higher level than usual, many pigs arriving at bacon factories are not in the primest of condition. When slaughtered their carcasses dress out soft, slightly discoloured, and, on grading, are classed as of other than the choicest grade; in fact, some are very fat and too heavy.

In some instances the fat is soft and oily, and in others it is of a slightly yellowish colour and will not " firm up " during the chilling process. If used for small goods, this soft, oily, discoloured meat still carries objectionable features. The loss to the industry through this trouble, plus the lower condition of many of the pigs that kill out to advantage, must be very heavy, for it is impossible to expect factories to pay top prices for second or third grade carcasses.

The Department of Agriculture and Stock, therefore, offers the following advice to farmers, especially in districts south of Rockhampton:—

Soft Oily Pork.—Although several foods may be responsible for this soft condition, all the evidence points to the fact that the chief cause of the trouble is the feeding of peanuts to pigs which are being finished or topped up for the market. Maize and other grain foods are, at present, relatively scarce and high priced, and as peanuts produce particularly fast growth in pigs, farmers are naturally tempted to use them in place of grain. The position could be relieved if pig raisers would concentrate their peanut feeding on the breeding stock and young store pigs, which will make very good use of surplus peanuts, and then other foods available could be kept for the pigs from the store stage until they reach bacon weights. Separated milk, root crops, pumpkins, lucerne (either as green fodder, hay, or chaff), and small quantities of pollard, meat meal, and pasture can be used to make up good rations in the absence of maize.

Yellowish-coloured Pork.—It is known that the probable cause of this condition is an excess of carotin, a colouring matter in plant life, and which is present especially during the early life of the plant and at the stage when (as in the case of pumpkins) the crop is fully ripe or over-ripe. The feeding of an excess of green wheat, oats, or barley, in the absence of, or short supply of, milk may also be responsible; so also may the continuous use of grass or of lucerne as the principal food.

Low-conditioned Pigs.—Lack of condition is, of course, invariably due to lack of sufficient nutritious food. When pigs are in such a condition they become more liable to infestation by internal and external parasites, which irritate the animal and cause much restlessness, especially at night.

It is better to keep fewer animals and to feed them properly than to attempt the keeping of more than the number for which food is available, and it is better to market the pigs when light and prime than to carry them on to heavier weights with loss of condition. Where milk is in short supply meat meal may be used as a substitute, and in all cases the pigs should have clean drinking water and charcoal.

Bruised and Damaged Pigs.—Where pigs are weakened as a result of lack of condition and where they are soft in texture—the result of improper food—they bruise more rapidly, and tend to be more discontented. The only way to avoid bruising is to have the animals in the primest of condition (not over-fat) and to treat them kindly and not force or beat them when loading or unloading. Avoid knocking them or forcing them through narrow gateways or over rough stony yards.

Over-fat Pigs.—Despite dry weather and high priced foods, there is still an abnormal proportion of over-fat and very heavy weight stock coming forward. Pigs should not be fed too heavily on grain, but be kept growing and be given abundant exercise in grassy pastures. It is a mistake to keep pigs penned up continuously in small sties and bare yards. The use of flesh-forming foods like milk, meat meal, lucerne, greenstuff, &c., and mineral matters will tend to overcome any tendency to over-fatness.

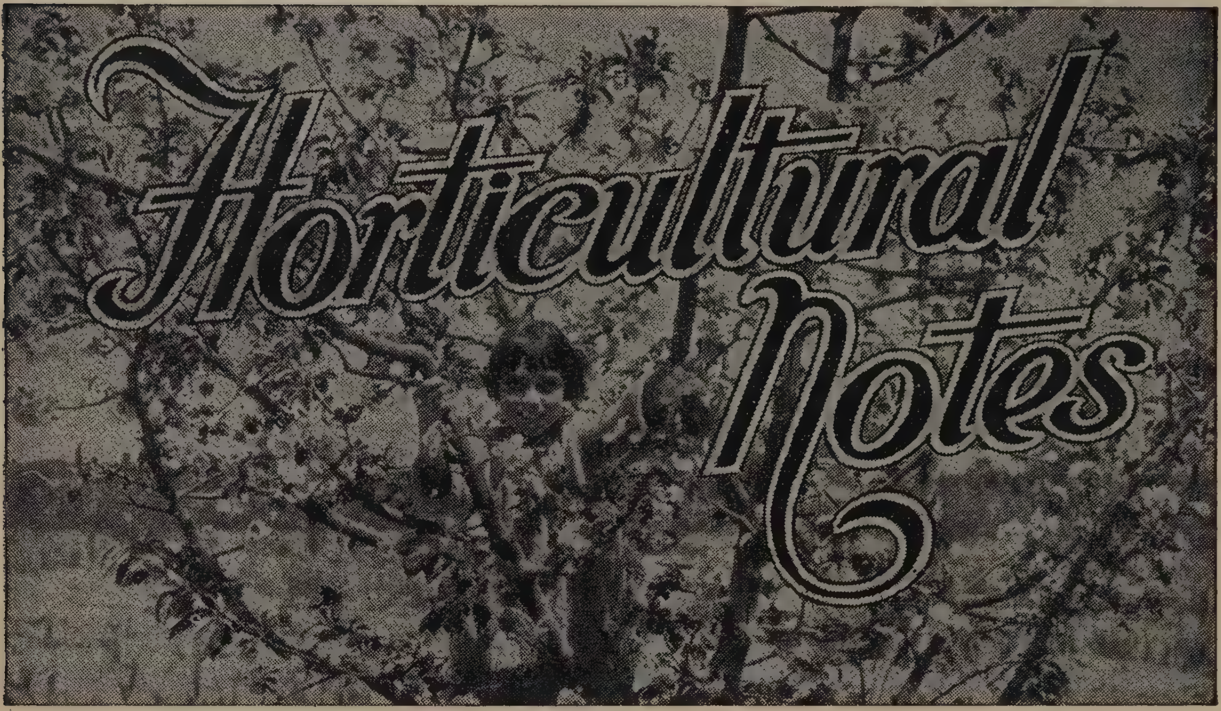
THE ZEBU CROSS.

The experiment of the Zebu cross now being carried out in the Central District is reputed to be pleasing to those who made the venture, and although another year or two must elapse to allow the progeny to reach maturity and the beef to be placed on the English market, the results are awaited with keen interest.

Previous experiences indicate that the progeny mature earlier than any other breed or cross, and from birth will increase in weight much more quickly; thus it is possible for the beef to reach the market months in advance of other beef.

Other factors in its favour are that it is not no susceptible to diseases and tick infestation; it is a better " doer " in times of drought, being a quick mover " on the leg," which enables the Zebu cross to reach feed and water in much less time than ordinary cattle, and so retain condition for a longer period. The Zebu cross-bred animal never loses the wild or natural instinct, which probably accounts for its grazing when other animals are resting.

Some thirty years ago a number of Zebu bulls were imported into Queensland and mated with Shorthorn cows, and the beef was highly commended on the English market. The progeny should be crossed back to herd bulls—preferably with Shorthorns, because they are more docile, throw off better colours and conformation.—M. J. B. Ashe, Inspector of Stock.



SOME TROPICAL FRUITS.

S. E. STEPHENS, Northern Instructor in Fruit Culture.

No. 14.—THE STAR APPLE.

THIS tree is one of strikingly ornamental foliage, but in spite of its decorative value it seems to have been very infrequently planted in places beyond its native habitat. In North Queensland only one specimen is known to the writer.

The tree originates in Central America and the West Indies, where it is stated to be of frequent occurrence in the natural forests, as well as being commonly cultivated in home gardens. It grows to 30 to 50 feet in height, and is of open, rather straggling habit. The foliage is peculiarly striking, the upper surface of the leaves being dark olive green and glossy, and the under surface reddish-brown with a satiny sheen. The young shoots are of similar appearance to the under side of the leaves, and all the satiny portions are heavily pubescent.

The tree breaks into young growth during the winter months and makes a rapid growth. Flower buds are then immediately produced on this new growth and are usually plentiful by the end of July. They are, however, very small and may be easily overlooked. The flowering period extends over a month or two. The fruit is bright-green with a smooth glossy skin while it is growing. When ripe it may be either green-skinned or dull purplish. The colour of the ripe fruit seems to be the sole distinguishing mark between two races or varieties of this tree. Flavour and other characteristics of the two races are reported to be the same. When fully grown the fruit reaches about 3 inches in diameter and is round to oblate in shape. On cutting the fruit transversely, the half-section demonstrates the origin of the common name. Radiating from the central axis of the fruit some eight segments of whitish translucent pulp are arranged. These segments, each of which normally contains one seed, form the characteristic star from which the fruit is named. It usually happens that several segments are abortive, and consequently they are smaller than their two or three neighbours, which carry fully developed seed. The seed is commonly ovate or elliptic in outline, is rather flattened, and about ½ inch in length, and has a hard brown shell or skin.

Plate 60.
The Star Apple Tree.

Surrounding the segments mentioned above and between them and the skin of the fruit is a layer of rather dry flesh of similar colour to the skin. Both this flesh and the flesh of the segments is edible, and both have a sweet flavour, with acidity entirely lacking. Like other sapotaceous fruits, the Star Apple contains a milky latex when immature, and consequently must be allowed to mature fully before it is harvested. In fact, the flavour of the fruit is really at its best if the fruit is allowed to ripen on the tree. In Queensland the ripening season is January and February. The Star Apple is primarily a dessert fruit, but occasionally is preserved or made into sherbert.

The tree is commonly raised from seed, which germinates best when sown in a light sandy loam. Unlike the seed of many tropical fruits, those of the Star Apple retain their viability over a period of several months, and consequently may be easily transported from one country to another. Considering this, it is indeed remarkable that the tree is not more widely distributed through the tropics than is the case. As seedling trees vary considerably in productivity and other desirable characteristics, asexual methods of propagation are preferable. P. J. Wester has demonstrated that shield budding may be successfully practised on them by using non-petioled budwood, cutting the buds 1½ to 2 inches long and inserting them in that portion of the stock having a similar appearance to the scion. Well-ripened cuttings of the tree are also reported to root successfully if bottom heat is used.

Plate 61.

Star Apple Fruit About Half Grown.

As the Star Apple is in active growth during the greater part of the year, it is necessary that it should be grown in a climate having a fairly high temperature throughout the year. Cold winters are definitely deleterious. Humid atmospheric conditions are most favourable. As regards soil, the tree seems to have cosmopolitan tastes, as Popenoe reports that it thrives well on both shallow sandy soils and deep clayey loams in America. Probably good soil moisture is one of the main factors of the soil aspect.

Star Apple seems to be the common name of the tree in all English-speaking countries. Spanish countries use the specific botanical name "Caimito." The botanical title is *Chrysophyllum caimito* L., and the tree is of the order Sapotaceæ.

PASSION FRUIT GROWING ON THE SOUTH COAST.

J. McG. WILLS, Fruit Branch.

ALTHOUGH passion fruit growing may not attain the same importance as banana growing on the South Coast of Queensland, it certainly offers prospects of a reasonably profitable return to those who are prepared to give close attention to the cultivation of the passion vine.

Considerable interest is being evinced by many landowners in the possibilities of passion fruit as a payable crop on land which has been used for banana growing, thus preventing its return to unproductiveness or pasture.

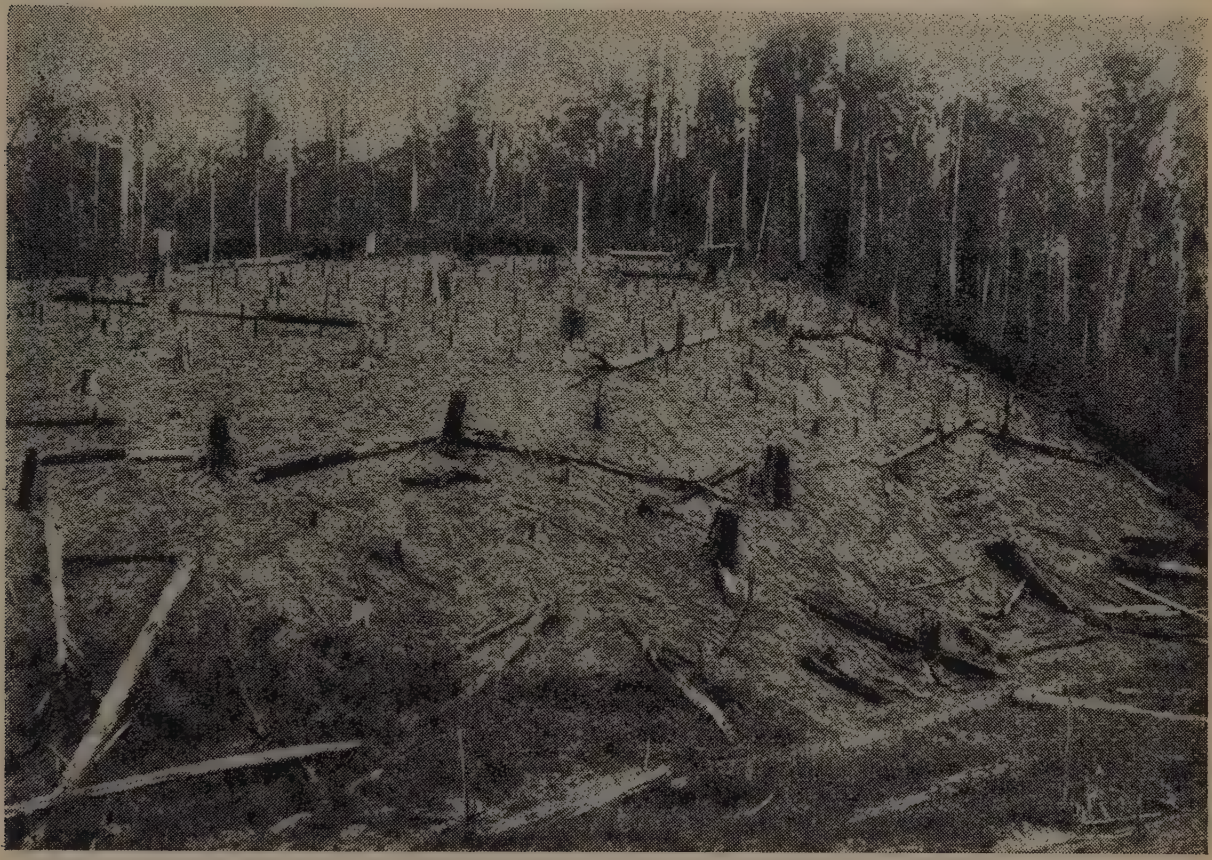


Plate 62.

Rain forest or "Scrub" land cleared for planting. Note the use of logs to assist in conserving surface soil.

The common purple passion fruit (*Passiflora edulis*) is the principal variety grown and has been cultivated commercially in Australia for over forty years, but its cultivation in most other countries has not become one of great commercial importance, due mainly to natural climatic difficulties. It cannot be grown in Britain or Canada, while in California its cultivation is negligible. Outside Australia the largest cultivated areas are in South America.

There is a regular demand for passion fruit products. Its delicious flavour has secured for it a wide demand as a dessert fruit, and its suitability as an addition to preserves, jams, and fruit salads has earned great popularity for it within the Commonwealth, and the demand is increasing. The increasing use of pure fruit juices in the manufacture of cordials has created such a regular demand that future market prospects are very encouraging.

Large areas of land are being put under passion vines with the object of processing the pulp for export overseas; while the prices paid for passion fruit on the fresh fruit market can be described, by comparison with other classes of fruitgrowing, as highly satisfactory.

Progress should be moderately slow and soundly based. The prospective grower is recommended to commence with a small area, which may be increased when he feels competent to handle an increased acreage. The best results are obtained by those who are willing to specialise in passion fruit growing, and only those who are prepared to apply the energy the industry demands are recommended to engage in it. Disappointment and possibly disaster will result from hit-or-miss methods. Four or five acres of vines is the maximum area one man can attend to if horse-drawn or mechanically driven cultivators are to be used. On less accessible sites where cultivation must be all accomplished by hand, for efficient working the area must be substantially reduced; and an area of two or three acres will be found quite large enough to occupy the full time of the grower.

Plate 63.
Another view of a "Scrub" clearing with trellis posts in position.

Departmental bulletins dealing with the very important subject of passion fruit diseases and their control are obtainable free on application to the Under Secretary, Department of Agriculture and Stock, William street, Brisbane, B.7.

Climatic Conditions.

The South Queensland coastal climate is eminently suitable for passion fruit growing, as the vine grows and thrives in warm humid conditions, such as are experienced in the coastal area. Unfortunately, fungus diseases, such as brown spot, which attack the aerial parts of the vine, also thrive under similar climatic conditions.

Under normal seasonal conditions, the general heavy rainfall assures sufficient soil moisture during the greater part of the year, the exception being perhaps in early spring. However, by proper cultural methods provision may be made whereby the vines can withstand dry weather without appreciable loss of vitality.

In this region frosts occur on flat and low-lying land, but severe frosts are rarely experienced on higher country. When selecting land for passion fruit growing this fact should be kept in view. Light frosts will do little harm to the vines, but a severe cold snap may affect this plant so badly asto kill all the top growth.

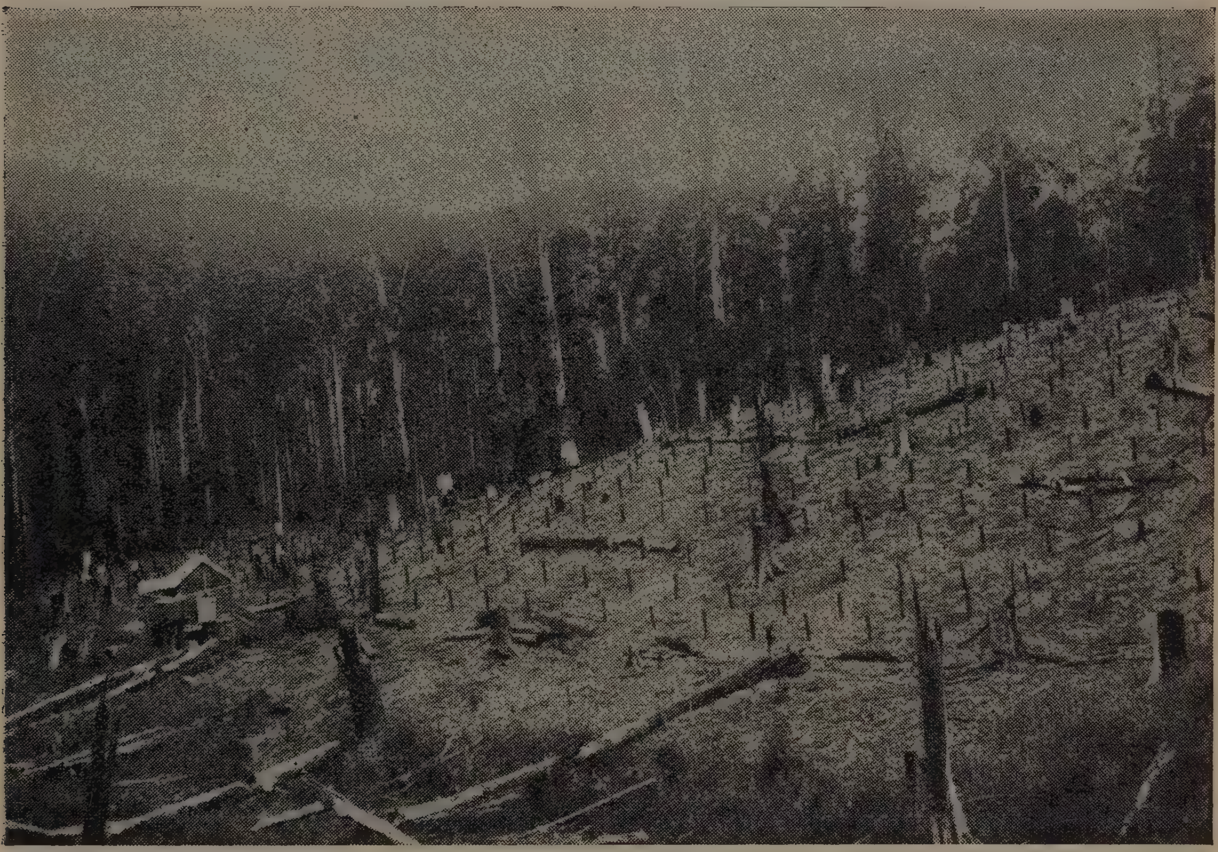


Plate 64.

Sloping land prepared by hand labour. Note the logs laid across the face of the hill. to minimise soil erosion.

Coastal winds and their effect on the plant must also be considered. for a heavy blow may cause appreciable damage to vines, fruit, and trellis. Cold winds affect the blossoms and the setting of the fruit, while hot dry winds promote excessive transpiration, resulting in the shrivelling, marking, or bruising of hanging fruit, lessening its attractiveness when ripe and reducing it in grade. In some localities strong winds accompanying heavy rain may also cause a collapse of trellis with consequent loss of fruit, expense of re-erecting the trellis, and increased spraying costs in respect of the control of brown spot, which spreads rapidly when the vines are lying on the ground.

Cropping Habit.

The passion vine bears its fruit on the current year's growth. This growth is produced mainly from year-old wood. Under average conditions, vines flower during August, September, and October. The blossoms are formed at consecutive nodes along the new growth on young leaders and laterals. The age at which the vine commences bearing depends on its strength and vigour; also on the season of planting. Vigorous plants commence to bear earlier than the less robust ones, and may bear a few fruits at from five to six months. As a general rule, however, when the vines are planted in early spring the first crop of any commercial importance will be harvested in from twelve to fifteen months from the time of planting. If planted late (in March and April) profitable crops may not be harvested until after 18 to 24 months have elapsed. Ordinarily the vines reach maximum production in from two to two and a-half years. From then onwards they decline gradually, yielding less each subsequent year until at from four to five years old the vines become unprofitable commercially. The old vines should then be removed and the area rested, replanted, or used to produce alternative crops.

Plate 65.

Young seedlings two months after planting. Observe the width between the wires on the trellis, and the solid wind-break at the rear.

As it takes approximately ten weeks from the time the fruit sets to the time of harvesting, marketing of the summer crop commences from about October and may extend to January, with the heaviest pickings during November and December. The subsequent crops produced —intermediate and winter crops—depend on the amount of new growth put out by the vines. This growth is influenced by seasonal conditions, health of the vine, and the quantity of fruit produced by the previous crop.

Heavy cropping retards the production of new growth, as the energy of the vine is absorbed in supporting fruit until it reaches maturity. More or less continuous growth, however, has been known during some seasons, with its consequent production of a certain amount of flowers and fruit throughout the whole year. Such habits are not normal, however, and have the effect of preventing the production of a definite seasonal crop. Provided the summer crop is normal and allowed to mature, and seasonal conditions have been suitable, new growth is likely to appear during November and December. The production of this growth is particularly noticeable immediately following the removal of the summer crop. This new growth is more often produced on young vines up to two years old than on older vines. On the new growth blossoms appear which provide the intermediate crop. If the summer crop has been normal and allowed to mature, this intermediate crop is, however, rarely very heavy. If the summer crop is removed or pruned while still immature the vines will then put forth vigorous new growth in November and December, and a larger and more satisfactory intermediate crop will result. Winter crop fruit is set when the vines blossom in February and March, and this crop should be harvested during the latter end of May, on to July. The season at which the vines blossom, and the length of time the fruit takes to mature are influenced greatly by warmth of locality and site, as well as altitude.

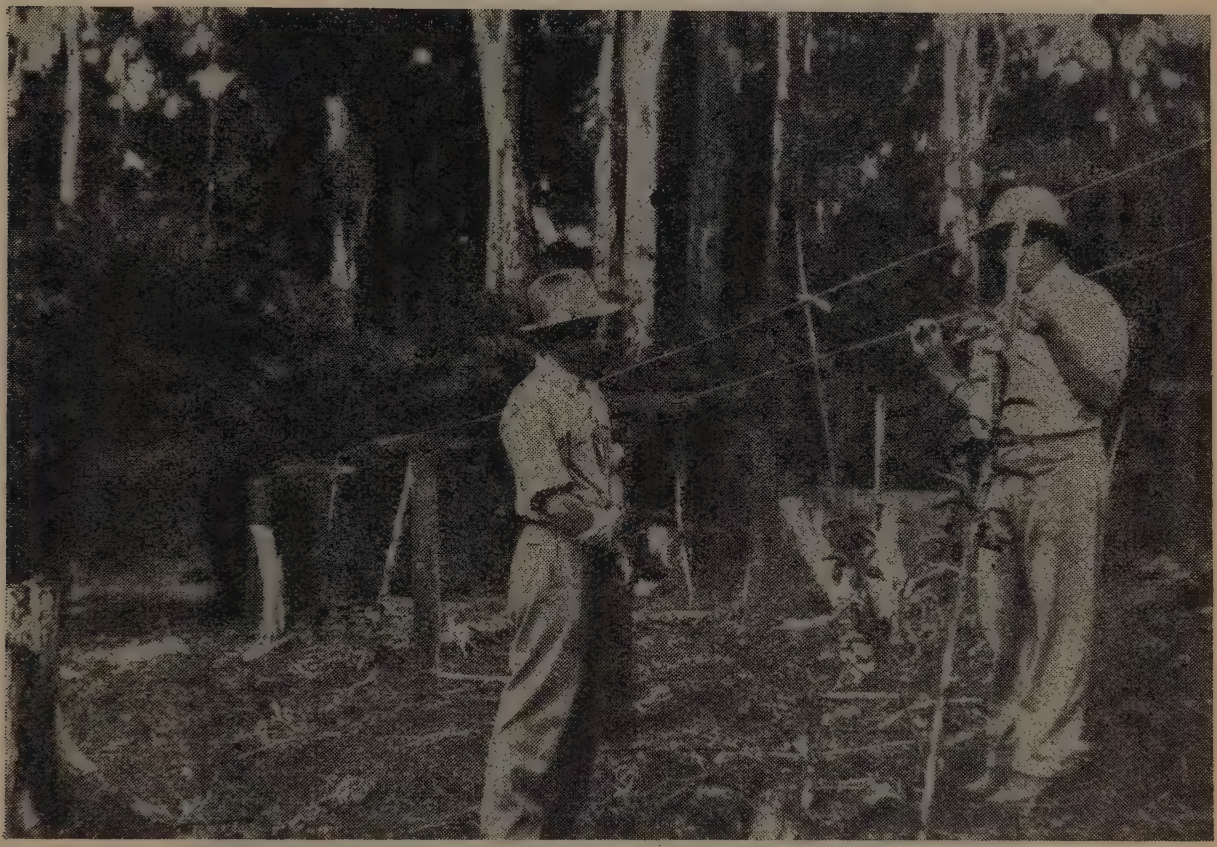


Plate 66.

A horizontal trellis having 2-ft. spreaders. Note the development of twin stems.

Fruit produced under warm growing conditions is less subject to woodiness or "bullet disease"; consequently the fruit is of better quality, and production and market returns higher.

[TO BE CONTINUED.]

CITRUS CULTURE IN QUEENSLAND.

R. L. PREST, Instructor in Fruit Culture.

[*Continued from p. 92, January, 1937.*]

Cultivation.

Differences of opinion which occur concerning the best method of cultivation for citrus fruits may be partly explained by the fact that soils vary in character and in the amount of moisture and fertility they contain. The systems adopted must, therefore, necessarily vary somewhat in order to meet the requirements of the particular soils.

In Queensland cultivation is an essential orchard operation, and is beneficial in the following ways:—

It improves the physical condition of the soil by making it finer and increasing its depth, thus presenting greater feeding areas to the roots.

The effects of extremes of temperature are reduced, as air is permitted to penetrate to the roots.

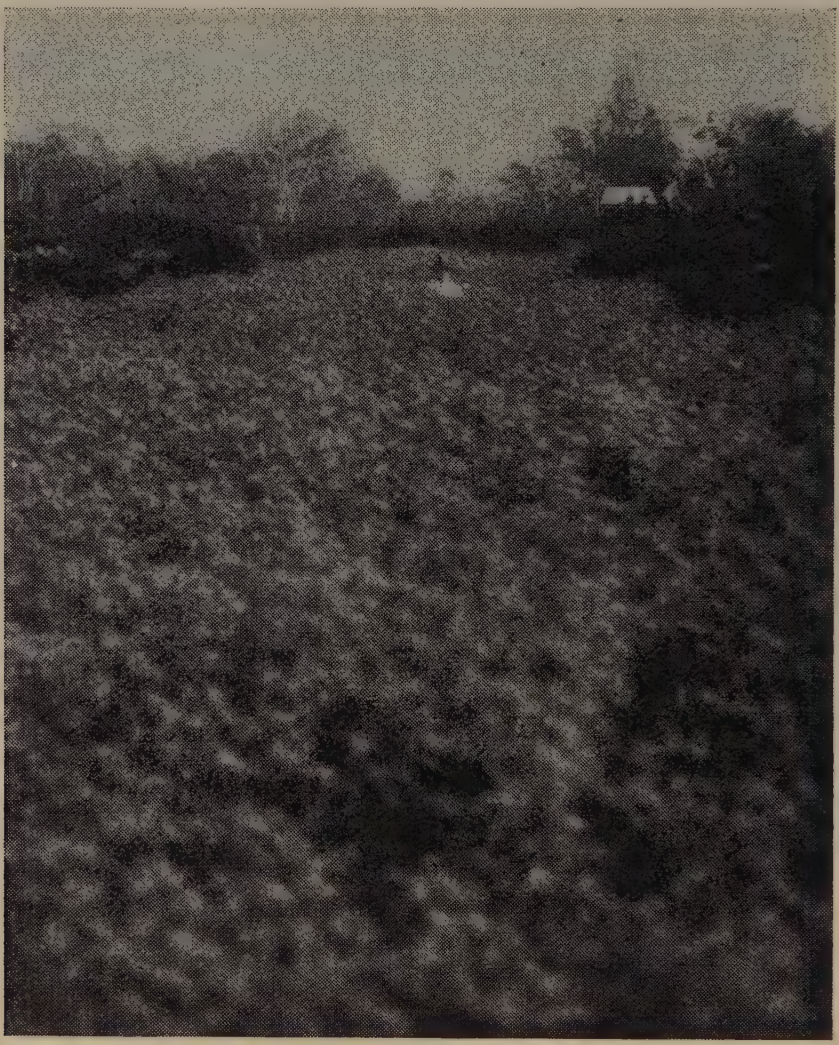


Plate 67.

NEW ZEALAND LUPINS.—Tops wet:—36 tons to acre. Roots:—4.8 tons to acre.

In cultivated soils decomposition and nitrification go on more readily, and if materials are present from which nitrogen can be set free, its liberation takes place more rapidly than if the soil is uncultivated.

It increases the water-holding capacity of the soil and conserves moisture.

Plate 68.
NEW ZEALAND LUPIN—Note Root Nodules.

Plate 69.
AN ORCHARD COVER CROP.—Note the cultivated strip along each side of the tree row.

On the other hand, the fact must not be lost sight of that cultivation may cause injurious effects. Unless care is used, plough-sole may result, and greatly hinder proper water penetration. Also, continous cultivation causes the destruction of the organic contents of the soil, and a decrease in the bacterial life. If cultivation is continued throughout the whole season year by year, such soil will soon become depleted of its natural fertility, and the trees will show the effects by their unhealthy condition.

Plate 70.
A WINTER COVER CROP.—Field Peas and Barley.

The loss of soil organic matter is a major problem in tropical agriculture in all parts of the world, and is particularly severe in many of our citrus plantations. Therefore, when considering cultivation programmes, the improvement of the humus content of the soils must be of primary importance. Where young trees are concerned, deep cultivation is advisable in order that large quantities of organic matter, such as manure and green manure crops, can be deeply incorporated with the soil There should be no danger of injury to the roots of young trees in cultivation to a depth of 10 or 12 inches. However, as the trees become older, their rooting systems extend widely in all directions, and, therefore, as deep cultivation will be liable to cut too many feeding roots, shallower cultivation will probably be more satisfactory.

In order to prevent the formation of plough-sole, cultivation at varying depths is frequently practised. However, plough-sole will form in many soils even though the depth and direction of the ploughing is varied, and in such cases subsoiling to a depth of from 18 to 20 inches may have to be resorted to in order to break up any hard pan that may be present. Such work should only be done when the soil is dry, and the subsoiler should be run only in the middle of the rows, otherwise severe root-cutting will result. Subsoiling should not be carried out either just prior to or just following the blossoming period.

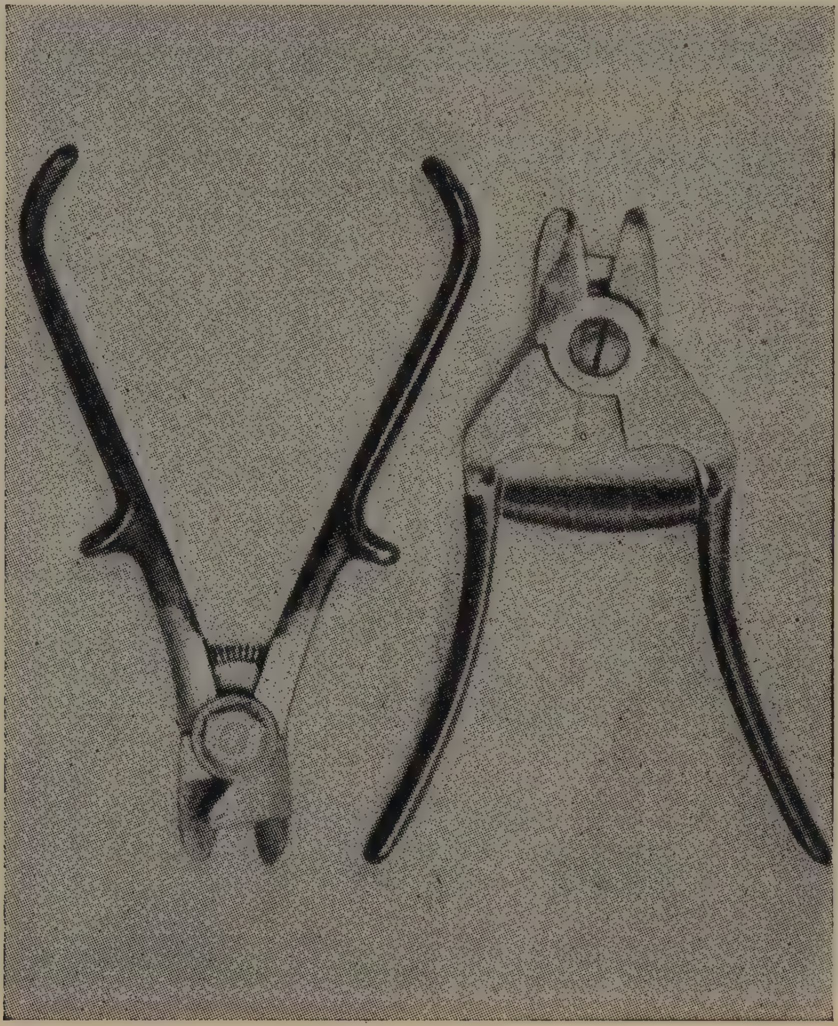
Green Manuring.

Humus, the product of the decay of organic substances, is one of the most important ingredients in any fertile soil, and, generally speaking, is present in only inadequate amounts in most of our citrus soils. Except in alluvial lands periodically improved in fertility by floodings, the orchardist must consider the maintenance or improvement of the soil fertility if he wishes to harvest good crops. In the absence of bulky organic farmyard manure, the maintenance and improvement of the soil fertility may be carried out by the growing and turning-under of green manure crops. Not only do such crops build up the physical condition of the soil, but their presence reduces soil losses by erosion during periods of heavy rainfall. When green manuring, particularly in the coastal districts, the general practice has been to utilise the summer rainfall, planting such crops as black cowpeas, Poona peas, and Crotalaria during November and December, and turning them under about the following March. Winter green manuring with crops such as beerseem (Egyptian clover), vetches, field peas, tick beans, lupins, rape, and mustard could in many instances be practised with advantage particularly in young orchards, and in orchards on the lighter, sandy soils, and where irrigation is practised. For winter crops planting should take place during March and April, and turning-under in July. Citrus trees up to four or five years of age occupy a relatively small proportion of the total area on which they are planted, and their roots do not

Plate 71.

WINTER COVER CROP.—Young Tick Beans.

extend so far from the trunk nor take up the amount of space occupied by those of old-established trees. Thus during the early years of a citrus orchard an excellent opportunity is afforded for building up a reserve of vegetable matter in the soil. At this stage cultivation, even early in the season, may be confined to the immediate vicinity of the trees, and by far the greater amount of space down the centres of the tree rows occupied by growing and turning under summer and winter green manure crops.



[From photograph by H. Clarke Powell in "The Culture of the Orange and Allied Fruits."

Plate 72.
Clippers designed to minimise injury to the fruit.

Fertilizing.

In reasonably fertile lands the addition of artificial fertilizer to the soil either before or at the time of planting is unnecessary, but in land that has been previously cropped or which would not be classed as fertile, assistance to the growing plants in this direction is required. No matter what fertilizer is applied, it should be incorporated with the soil so that the young roots in traversing the soil may come in contact with it. However, it should not be brought into direct contact with existing roots at the time of planting.

As the trees develop, the quantity of fertilizer required for each will correspondingly increase, and when fully developed an evenly-continued, regular supply is necessary. As crops are produced, so the natural fertility of the soil is being depleted, and where it has not been restored by the application of such fertilizer as is available, the effect is shown by impaired vigour of the trees and poorer quantity and quality of the fruit produced. General observations made from field trials indicate that nitrogen is one of the main constituents required to maintain healthy and vigorous citrus trees, but at the same time phosphoric acid and potash have their place. At least 6 cwt. of ammonia to the acre, with 3 cwt. of phosphoric acid and 2 cwt of sulphate of potash, would be a basis for a fertilizing programme for mature bearing trees. The nitrogen is best supplied so as to be available during the spring, as such practice tends to increase the crop and improve the quality. Whether or not an autumn application will be necessary will depend upon the vigour of the trees, as it must be remembered that the promotion of too much vigorous growth at this period is detrimental to the production of high-grade fruit. However, it will be found that a light dressing of nitrogen, with rather increased quantities of phosphoric acid and potash, will assist in maturing autumn growth and future fruiting wood, and will also benefit the crop.

The value of lime in citrus culture may be viewed from two angles,—its influence on the trees, and its effect on the soil. The presence of lime appears to aid the vigour of the trees, and improve the delicacy of the fruit, while in the soil it corrects acidity, improves the physical condition, aids the decomposition of organic matter, stimulates bacterial activity, and generally assists in improving soil fertility. Lime should be applied in the autumn in the form of agricultural lime, as its action in the form of powdered quicklime or air-slaked lime is too rapid and powerful.

Harvesting.

The subject of careful handling of fruit has been so frequently stressed that further details here seem superfluous. The chief points to be remembered are that the fruit should be cut from the tree as close to its base as possible (an orange clipper specially made for the purpose is available at a nominal cost), and that it should be treated as fragile during the first and all subsequent handlings, and carefully stored and graded before packing. Various grade sizers are obtainable, and selection can be made according to the output of the orchard. Wrapping the choicest fruit when packing enhances its appearance and increases its value, besides having other advantages, such as prevention of the spread of storage and transit diseases. Fruit should be gathered only under the driest possible atmospheric conditions, and never, as is often done, during showery weather. It should be sweated for at least seven days, and then carefully graded for blemishes and disease, sized, and packed.

Colouring.

No fruit should be gathered from the trees until it has reached maturity. The maturity standards for citrus fruits are as follows:—

In the case of oranges, grape fruit, and mandarins, the weight of the hand-pressed juice must be not less than 30 per centum of the total weight of the fruit.

With regard to the juice, in the case of navel oranges and mandarins, 10 cubic centimetres of the juice shall be neutralised by not more than 26 cubic centimetres of deci-normal (N/10) alkali; and in the case of oranges (other than navel oranges and mandarins) 10 cubic centimetres of the juice must be neutralised by not more than 30 cubic centimetres of deci-normal (N/10) alkali.

As citrus fruits are only sold to their best advantage when they are mature, full-flavoured, and showing an unblemished skin with its normal ripe colour, assistance by colouring to such fruit as lack normal colour but possess the other qualities will enhance its market value. Citriculturists who have had experience in various citrus-growing localities will agree that certain varieties of oranges and mandarins growing in the cooler regions have ample colour long before they attain sufficient sugar to make them desirable for eating purposes, while those produced in warmer climes are sweet and luscious for some time prior to their attaining a normal ripe colour.

The colouring or forced curing, a practice known in California as ''sweating,'' was formerly done by gaseous products generated from kerosene stoves. In 1924 Denny found that ethylene gas in small quantities was capable of producing the same results. He also found, however, that a very high percentage of gas (for example, 80 per cent.) delayed colouring. Colouring was also delayed by temperatures as high as 92 degrees Fahr. and as low as 45 degrees Fahr. A temperature of between 60 and 70 degrees Fahr., with a humidity of from 70 to 75 per cent. was found to be satisfactory.

Ethylene gas can be obtained in metal cylinders under a high pressure, with regulator valves attached to the cylinders. When released from the regulator valve the gas is conveyed by tubing into the colouring chamber. The quantity of gas passing into the room is recorded by the valve on the cylinder, so that the correct charge according to the size of the chamber can be readily determined.

It has been found that a very small quantity of acetylene gas (1 part in 2,500 to 1 part in 1,875) satisfactorily colours mature citrus fruits. In order to determine the dosage required, the air space remaining after the chamber has been loaded must be known. One ounce of carbide generates sufficient gas for every 75 cubic feet of air space. For all practical purposes it is sufficient to allow 1¼ cubic feet displacement for each bushel case of fruit. For example, the following table illustrates the dosages required for a chamber of 200 cubic feet capacity with a varying number of cases:—

No. of Bushel Cases.	Air Space.	Dosage.
40	150 cu. ft.	2 oz. Carbide
20	175 cu. ft.	2⅓ oz. Carbide
10	187½ cu. ft.	2½ oz. Carbide

In order to satisfactorily colour citrus fruits, they must have reached maturity, as if too green or immature they will not develop a normal ripe colour, but will shrivel and become dull and dirty in appearance.

All fruits to be coloured require to be treated with special care in handling. Bruises will show up as greenish areas; oil liberated from the rind may cause spotting; while if the residues of oil or Bordeaux sprays remain on the fruit, it will be found to come from the colouring room spotted and unsightly.

Any ordinary room lined with timber, provided it is air-tight, can be used for colouring citrus fruits. A convenient and economical size is one to hold from 40 to 50 bushel cases; allowing 5 cubic feet of air space to each bushel case, the chamber would require to be from 200 to 250 cubic feet in capacity. Even where large numbers of cases are to be treated, it will be found more satisfactory to build two medium-sized chambers than one large chamber.

For oranges, lemons, and mandarins an average temperature in the chamber of between 65 and 75 degrees Fahr. will prove satisfactory. If the temperature falls below 65 degrees Fahr. the colouring process will be retarded. On the other hand, high normal temperatures are not likely to affect the fruit, no ill-effects having been shown by temperatures up to 89 degrees. However, the humidity will require to be adjusted; in the case of a very dry atmosphere an open container of water may be introduced to moisten the air and prevent withering of the fruit; while when the humidity is high and likely to cause softening of the fruit, it may be reduced by placing sand, caustic soda, or quicklime on the floor of the chamber.

The fruit should be graded for colour and placed loosely in open cases having plenty of ventilation. Dunnage should be used in stacking so that a free circulation of air around each case is permitted.

The required quantity of carbide should be placed in a suitable container, and a second vessel containing water arranged in such a manner as to permit the water to drip slowly on to the carbide, thus generating the acetylene gas. This apparatus may be fitted either inside or outside the chamber; if the latter, of course, the gas will have to be led inside the chamber by means of suitable piping.

After closing the chamber and making sure that it is airtight, it should be charged and allowed to remain close for four hours. It should then be opened up and thoroughly aired for at least two hours, after which it may be charged again, and the performance repeated as often as is necessary. Between nine and fifteen charges should be sufficient to give mature citrus fruits their normal colour.

Picking and Curing of Lemons.

Lemons carefully handled and gathered at the right stage of maturity may be successfully cured and stored on the orchard for several months without deteriorating, but rather with improvement to their appearance and carrying qualities.

All fruits should be clipped, not pulled, from the trees just as they are turning colour. The fruit should be of normal size, and the dark-green colour just turning to a paler shade, generally termed "silvering." In order to avoid injuring or bruising, and thereby leaving the fruit open to the attack of moulds, it is important to remember that it must at all times be handled wih the very greatest of care.

After picking the fruit should be placed in shallow trays and allowed to remain for several days to sweat off excess moisture. When storing for any length of time, dipping for a period of one or two minutes in a bluestone solution, strength 1 in 500, is recommended. The fruit, after being thoroughly dried, is packed in bushel cases and stacked in a storing chamber in such a manner as to permit a ready circulation of air.

Such chamber should be so constructed as to lend itself to control of the relative humidity. A low relative humidity results in the shrinkage of the lemons, with a consequent loss of weight and an inferior colour in the fruit, accompanied by shrivelling, as well as the browning and dropping of the buttons of lemons held in storage for any period. These conditions are mostly apparent during late spring, a period of comparatively high day-time temperatures and low relative humidity. Satisfactory conditions may be obtained by controlling the humidity at from 85 to 90 per cent. For controlling the humidity a humidifier may be cheaply constructed by hanging a series of absorbent cloths from a frame, above which is fixed a small perforated iron water-pipe permitting water to drip when required, and circulating the air in the chamber by means of a small fan. Under such conditions lemons may be stored for several months.

Another method used in storing lemons is, after sweating, to pack the fruit loosely, either wrapped or unwrapped, in cases lined with paper, and stack in a cool dry shed in blocks of from 50 to 60 cases covered with canvas sheets or tents. Low open water containers may be introduced when necessary, always taking care to avoid as far as is possible extreme variations in temperature and humidity. The fruit should be examined at intervals of ten days, and any showing signs of decay removed.

Again the fruit may be stored, either wrapped or unwrapped, loosely packed in cases lined with paper and using straw as a filler. The bottom of the case is covered with a layer of straw, a layer of lemons placed thereon, the spaces between the fruits filled with straw, and the lemons covered with a layer of straw, and so on, using alternate layers of fruit and straw until the case is filled. The cases should be stacked, covered, and periodicaly examined as described in the previous method.

REFERENCES.

The following is a list of principal works consulted:—

H. H. Hume—" The Cultivation of Citrus."
H. Clarke Powell—" The Culture of the Orange and Allied Fruits."
R. W. Hodgson—" The Pruning of Citrus in California."
G. Quinn—" Handbook for Fruit and Vine Growers."
Fawcett and Lee—" Citrus Diseases and their Control."
Lyon and Buckman—" Nature and Properties of Soils."

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CROWN LAND FOR GRAZING HOMESTEAD SELECTION.

CUNNAMULLA DISTRICT.

174,931 ACRES OF SHEEP LAND—PART OF THURRULGOONIA RESUMPTION.

This land has been surveyed as portions 5, parish of Cotton, 1 and 2, parish of Magie, and 1 and 2, parish of Kumbogan, and will be open for Grazing Homestead Selection at the Land Office, Cunnamulla, on Monday, 8th March, 1937, at 11 a.m.

Each selection will be for a term of 28 years.

The annual rentals for the first period of 7 years are from 1d. to 2¾d. per acre.

Each selection must be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of 3 years.

The blocks are all good woolgrowing country and are artificially watered by bore drains, but more water may be required.

Free lithographs and full particulars may be obtained from the Lands Department, Brisbane; the Land Agent, Cunnamulla; and the Government Tourist Bureaux, Sydney and Melbourne.

The COTTON INDUSTRY

THINNING AND SPACING OF COTTON.

W. G. WELLS, Director of Cotton Culture.

RESULTS obtained from the experiments testing the merits of different spacings of cotton plants, and heights at which to thin them, have indicated that soils and climatic conditions have an important influence in determining what is the best spacing of cotton plants. The habit of growth of the variety also has an effect; so it would appear that no one particular plant-spacing gives the best results under all conditions. It becomes necessary to consider, therefore, what spacing is the most satisfactory under a range of climatic conditions, for each variety on each soil type. This makes it advisable for each grower to carry out spacing tests over a series of years so that the best spacing for average conditions may be ascertained.

One point emerging from the experiments that have been conducted is that cotton must be spaced out to some extent, for the unthinned plants always tend to be more sensitive to climatic conditions. In wet seasons the unthinned plants, if on soils of a fertile nature and of a high nitrate content, grow very tall and spindly, which causes the suppression of the lower fruiting branches, with a consequent delay in the setting of the bolls. The crop thus tends to form rather late and, in addition, is subjected to the sucking insects that occur generally in greater numbers during the latter part of the season, particularly if showery weather prevails then. The lint produced under such conditions is frequently of a rather wasty nature, containing a considerable amount of stains and yellow spots. In dry seasons where the plants are left unthinned, the competition for plant food and moisture soon becomes so acute as to cause the loss of the flower buds, then the small bolls, and finally it restricts the development of the bolls that remain on the plant. This lowers the quality of the fibres contained in the affected bolls, for they do not reach full development, thus resulting in weak, wasty, and shortened fibres.

Although much more data is required in all districts to allow of a decision to be arrived at as to what is the most satisfactory plant-spacing for each variety and soil type, the results obtained indicate that for alluvial soils with varieties like Indio Acala, Miller, New Boykin, Ferguson, and Half-and-Half, spacing to 12 to 15 inches when the plants are 5 to 8 inches tall, can be relied upon to yield about as well as any over a series of years; and the quality of fibre produced is less likely to be affected by adverse climatic conditions. The Durango variety, with its tendency to develop more of a top crop on the large vegetative branches, appears to require wider spacing, particularly in seasons in which wet conditions in the second half are experienced. Spacings of 20 to 24 inches when the plants are 5 to 8 inches tall are, therefore, recommended for it.

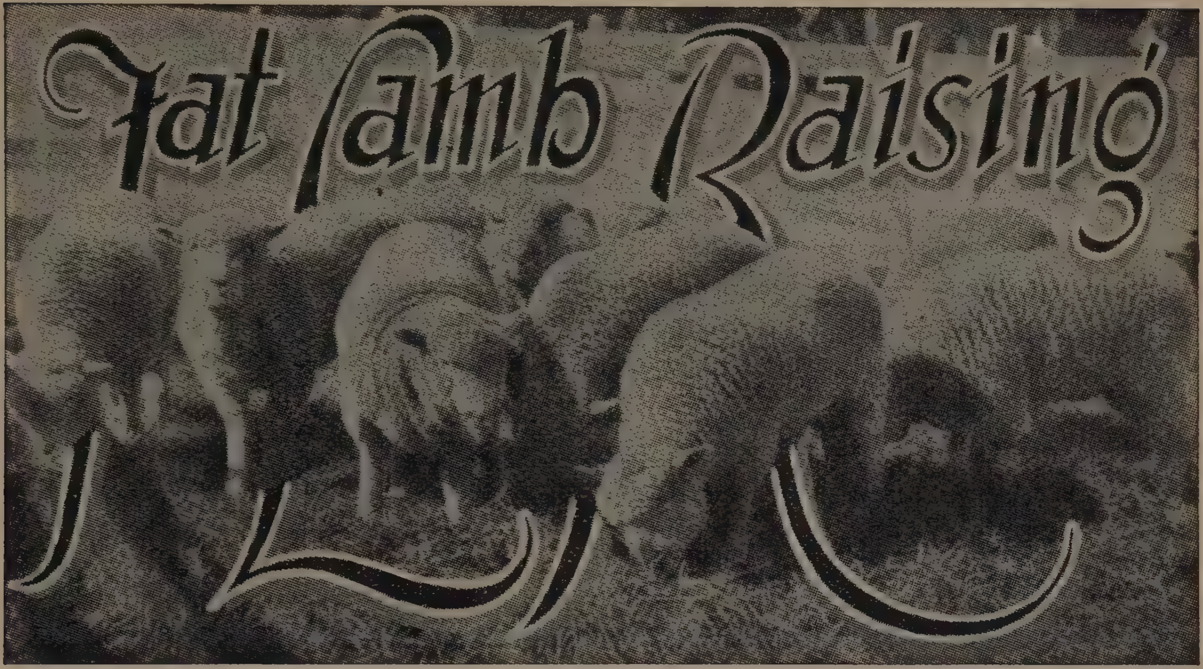
On the harder, less fertile clays and clay loams of the forest slopes —particularly in the drier districts—more drought-resistant, vigorous-growing varieties like Lone Star and Mebane are required. These varieties have produced satisfactorily over a series of years when spaced out to 20 to 24 inches. In a season of late planting, such as the present one, it is possible, however, that around 15 to 18 inches may be more advisable for December-sown plants, as fewer bolls per plant will likely be borne, so that having more plants per acre will tend to overcome the deficiency. The plants should not be left much closer than this in an attempt to compensate for the fewer bolls per plant, for the late plantings of these varieties will tend to grow very tall and spindly if left in a crowded condition, unless on soil of very low nitrate content, or unless rather dry conditions occur for the next two months.

The results of time of thinning experiments indicate clearly that it is best to thin when the plants are 5 to 8 inches tall, as this arrests the tendency for the plants to grow spindly and reduces competition for moisture and plant food; also, if the field has been cultivated and cross-harrowed to eliminate weed growth, the thinning operations can be performed easily and rapidly when the plants are at this stage. These are all important factors in late-planted cotton, which will grow very rapidly at this stage of the season if wet conditions are experienced.

COMFORT IN THE COWYARD IN WET WEATHER.

On many farms the cow yard becomes very boggy in the wet season, and conditions are then anything but pleasant for the milker, as well as the cow. The dairyman has to walk through mud and slush, sometimes up to or over his ankles, and the cows often drag their udders through the mud when walking into the bail from the yard. Consequently, the mud adheres to legs, udder, and belly, entailing a considerable amount of work in washing both teats and udder. If this cleansing job is not done correctly and thoroughly cream of inferior quality is delivered at the butter factory, for which only second-grade price can be paid.

To ensure comfort in the cow yard in wet weather, a small enclosure, 36 feet long and 36 feet wide, may be constructed. This small yard should be concreted. Sand and stone can be obtained quite handy to the farm as a rule, so the work can be done by the farmer at the cost of the cement. Dairy farmers who have adopted this idea declare that they wonder why they did not build such a "draining yard" before. It makes all the difference in the comfort of wet weather milking. A yard 36 feet by 36 feet will hold twenty cows quite comfortably.—D. A. LOGAN, Inspector of Dairies.



FAT LAMB BREEDING.

J. L. HODGE, Assistant Instructor in Sheep and Wool.

RECOGNISING that Queensland generally lags behind other States in the production of fat lambs, the Minister for Agriculture and Stock some time ago inaugurated a scheme for the encouragement of this branch of the sheep industry. Rams of British breeds were purchased in the South and distributed to farmers who had cultivation or promised to cultivate. The necessity for cultivation was urged on all farmers, it being thought by officers of the Department that fat lambs off grass country, even if prime, were more or less in the nature of a fluke. The breeds purchased were Border Leicesters, South Downs, Dorset Horns, Shropshires, and Romney Marsh.

In certain cases where a farmer owned a stud ram of particular breed, stud ewes were supplied with the idea of fostering the breeding of pure stock.

All sheep supplied to farmers are on loan, and remain the property of the Department. The progeny and wool, however, are the property of the farmers concerned.

The interest taken in the scheme, and the results to date, have been highly gratifying, and it is now no uncommon sight to see a pen of true sucker crossbred lambs on sale at Cannon Hill. Prices, too, during the period under discussion have been generally profitable.

The greatest drawback to the production of fat lambs on the Darling Downs in quantity has been in the past and still is the difficulty of purchasing good crossbred ewes as the mother flock.

If a start has to be made with Merinos the best for fat lamb raising is bred by the introduction of one of the longwools, such as Border Leicester, Lincoln, or Romney Marsh into the strong-woolled, robust type of Merino ewe. The ewe lambs of this drop should then be retained as the future dams of the lamb-raising flock.

As to suitable ewes for the fat lamb industry, it is believed that graziers on the fringe of the Darling Downs or further out would find it profitable to join long-woolled rams of British breed with their cast-for-age ewes with the idea of selling the progeny annually as fat lamb ewes on the Downs. Into the crossbred ewe flock, as described, should be introduced a ram of the Downs type. Opinions necessarily differ in the matter of crosses. The South Down is the fashionable lamb at the present time, but it should be remembered that this cross must suffer no check from birth to block. The Dorset Horn gives a very nice lamb, early maturing and hardy. The use of the Border Leicester should be encouraged in every way. In addition to an early-maturing lamb filling every want, it must be remembered that the skin value of this lamb is worthy of consideration to a far greater extent than either the Dorset or the South Down.

Pure-bred Corriedale ewes are hard to come by, but should the opportunity occur a farmer would be well advised not to let it slip. Pure Corriedales are hard to beat, good mothers and heavy milkers, besides growing a profitable fleece.

Generally, the wool from a flock retained for fat lamb breeding is a secondary consideration when compared with the production of fat lambs.

CODLING MOTH CONTROL.

The overwintering codling moth grubs are now assuming the chrysalis form, and a general emergence of moths may be expected to commence shortly.

A final inspection of packing sheds should now be made, and as many grubs and chrysalids destroyed as possible. It is of course impossible to obtain anything like a 100 per cent. kill of the grubs that harbour in the packing shed, but by careful searching many can be found and destroyed.

Second-hand cases or any cases stored in the shed should be dipped in boiling water for a period of three or four minutes, and this will kill all the grubs harbouring in joints and nail holes.

Although it is generally recognised that the packing shed is an important source of moth infestation each season, quite a large percentage of grubs also overwinter in the trees in the orchard, and they may be found in all sorts of cracks and crannies under the bark at the base of the trees, and at the juncture of the larger branches and in the main crotch or fork of the tree, and the time spent in searching for and destroying these grubs is well spent.

All growers should now set out a few bait traps as indicators of moth activity, as in this way fairly reliable information as to when the eggs are being laid can be obtained. When the greatest number of moths are found in the traps, it can be safely assumed that the greatest number of eggs are then being deposited, and as the eggs hatch in from five to ten days, according to temperature, information in regard to the timing of sprays can be thus arrived at.

Bait pans should be of about 3-pint capacity, and they should, if possible, be covered with a wire mesh screen or cover made from $\frac{3}{8}$ to $\frac{1}{2}$-inch wire netting. This will prevent the larger moths, such as cutworm moths, from entering the trap and spoiling the bait.

Any wide-mouthed vessel can be used for the trap, the wider the better, and enamel pudding basins of about 7 or 8 inches diameter make very good traps and are easy to fix the hanging wire to, but any tin or glass vessel of a similar diameter will answer the purpose.

One of the cheapest and best baits is made as follows:—

Crude molasses 1 part, water 16 parts.

The molasses is dissolved in the water and the trap about two-thirds filled with the mixture.

The traps are hung as near to the top of the tree as possible, as more moths are caught in this situation.

The hanging is easily accomplished by screwing a couple of screw eyes into one of the large branches near the top, a piece of stout cord is fixed to the wire handle of the trap, and the other end of the cord is passed through the screw eyes, enabling the trap to be easily raised and lowered for daily inspection and resetting when necessary. The trap should hang clear of the branch, and fresh bait should be used about every ten or twelve days.—HUBERT JARVIS, Entomologist.

The Importance of Forests in the Circulation of Water.*

THE part which forests play in the circulation of water on the earth's surface is not yet fully understood. There are many meteorologists and engineers who deny altogether the effect of forests on the amount and distribution of rainfall. The old theory that the source of all our precipitation over the continent is evaporation from the surfaces of our oceans is still prevalent. According to this theory, the vapour from the oceans is carried by the wind to the continent, there condensed in the form of rain or snow, and later returned through rivers back to the ocean. The circulation of water on the earth's surface was thus considered as going on in a somewhat horizontal direction between the ocean and the land.

Bruckner's investigations on the circulation of water in the atmosphere dealt a serious blow to this theory, and threw in bold relief the evaporation from the earth's surface itself as the most important source of our precipitation. According to his calculations, the oceans contribute only two-ninths of the entire precipitation that takes place over the land areas draining toward the oceans; seven-ninths of the precipitation over the earth is derived from evaporation from the land itself.

If evaporation from the land surface is the chief contributor of moisture to the air, it is of interest to know which of the various earth coverings contribute most vapour to the air. Studies of the loss of water from the different earth coverings show that free water surfaces of lakes and streams contribute less vapour to the air than bare, moist soils. Land covered with grass or crops contributes through direct evaporation and through transpiration more vapour to the air than bare, moist soils.

Of all the vegetative coverings, a dense forest contributes most vapour.

Experiments conducted in Germany by Wollny and Ebermeyer, by Henri of France, and by Otozky in Russia, all agree that the ground water is near to the surface in fallow ground, somewhat depressed under agricultural crops, and is lowest under forest cover.

The French aptly call the forests the "oceans of the continent," and compare the vapour given off by them to clouds of exhaust steam thrown into the atmosphere.

The reasons for the tremendous consumption of water by forests are clear. To produce one pound of dry wood substance, from 500 to 1,000 pounds of water must pass through the body of the tree. A forest, if it is fairly stocked with trees, produces at least 100 cubic feet of wood per acre per year, including root and branch wood. A cubic foot of coniferous wood weighs on an average 25 pounds, that of hardwood about 40 pounds. An acre of forest, therefore, produces on an average from 2,500 to 4,000 pounds per acre. To produce this amount of wood, from 2,500,000 to 4,000,000 lbs. of water will have to pass through the tree, and be given off into the air. If this water were distributed over an acre of land it would cover it to a height of 12 inches.

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*Abstract of address by Raphael Zon, Director, Lake States Forest Experiment Station, Forest Service, United States Department of Agriculture delivered at a meeting of The Mayo Foundation Chapter of Sigma Xi, Rochester, Minnesota, Friday, 22nd March, 1935. Supplied by Dr. H. Poate, a Sydney surgeon who is also a very keen horticulturist, to "The Fruit World and Market Grower" (Sydney), and printed in that journal for January, 1936.

Forests, therefore, lying in the path of prevailing winds blowing from oceans to continents enrich the air passing over them with vapour and help in carrying this moisture farther into the interior of the continent. We have in the United States a clear example of this influence in the forests of the Coastal Plain and the Southern Appalachian Mountains. The prevailing southerly winds of the summer, on reaching the shores of the southern States, are drained of the vapour derived from the Gulf of Mexico. In further movement north, they would, therefore, become dry winds, if not for the presence of the forests over which they pass. Passing over large stretches of forest, they become alternately enriched with vapour and drained of moisture, and in such relays the moisture is carried into the central and prairie region, making summer the period of greatest rainfall there.

Lowdermilk, in his recent investigation of the influence of the forest upon rainfall, found that the increasing dryness of the interior of China is brought about by the decreased humidity of the air due to deforestation. This, together with erosion following deforestation, has caused serious disturbance to the entire circulation of water in China.

For the same reason the forests of the Scandinavian peninsula must be important in the distribution of moisture over northern Europe.

Whether the forests actually increase rainfall may be a question, but the part which they play in the distribution of rainfall over the land has a good foundation of scientific facts behind it.

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STOCK WATERING FACILITIES.

On many grazing properties in Queensland there is sufficient surface water to last until June or July in a normal year, and possibly until August in a good year, when there has been a heavy wet season. There is a period between the time that the surface water dries up and the first storms fall in which it is necessary to provide water, either by well or bore.

When selecting a site for a well or a bore, the grazier should first make a survey of his country. A site should, if possible, be selected on a part of the property where cattle do not feed intensively when surface water is available. On a number of grazing properties the mistake has been made of putting down a bore in close proximity to the surface water. As the surface water dries up, the grass in the immediate vicinity is also eaten out, and when it is necessary to pump water for stock there is often no grass in close proximity to the bore or well. As a result, the stock are forced to travel a considerable distance out to grass.

When bores and wells are put down in places away from surface water, there will probably be grass near at hand in a dry time, and cattle will do better, drink oftener, and retain condition that they would otherwise lose through excessive walking.—D. A. LOGAN, Inspector of Stock.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, the Freisian Cattle Society, and the Ayrshire Cattle Society, production charts for which were compiled during the month of December, 1936 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORNS.				
MATURE COW (OVER 5 YEARS), STANDARD 350 LB.				
Eveline of Alfa Vale	W. H. Thompson, Nanango	15,517·2	708·434	Reward of Fairfield
JUNIOR, 4 YEARS (UNDER 4½ YEARS), STANDARD 310 LB.				
Alfa Vale Gentle 2nd	W. H. Thompson, Nanango	15,186·9	695·151	Reward of Fairfield
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.				
Sunny View Thelma	J. Phillips, Sunnyview, Wondai	12,310·65	520·374	Lovely's Commodore of Burradale
JERSEY.				
JUNIOR, 4 YEARS (UNDER 4½ YEARS), STANDARD 310 LB.				
White Rose of Hamilton	J. Wilton, Junior, Raceview	11,035·75	663·178	Retford Mary's Victor
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.				
Wyreene Creole	Mrs. M. Allom, Toowoomba	7,391·05	380·059	Lyndhurst Majesty
FREISIAN.				
SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD 330 LB.				
Ryfield Butterfly	F. C. Noller, Kumbia	10,043·95	407·812	Ryfield Monarch 2nd
AYRSHIRE.				
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.				
Myola Lady Jean	L. M. Anderson, Southbrook	8,391·86	368·183	Fairview Combination

The Tropics and Man

HEAT AND THE HUMAN BODY.

DOUGLAS H. K. LEE, M.Sc., M.B., B.S., D.T.M.,—Professor of Physiology,
University of Queensland.

No. 2.

The Body as a Heat-Producer.

WHATEVER we like to think about the ultimate origin of life and the development of its forms through the ages, this much is certain, that when life was first evolved upon this earth it was committed irrevocably to two principles—the use of oxygen from the air in furnishing energy for work, and the wastage or dissipation, to use the technical term, of much of that energy as heat. Engineers will recognise this latter statement as part of a larger truth which is given the imposing title of the *second law of thermodynamics*, and which entails that energy cannot be transferred from one form to another without the loss of a certain proportion as heat. The human body can be regarded as an engine. It must be provided with fuel in the form of food; it must be supplied with the oxygen of air so that it can burn up that fuel and liberate energy; it has mechanisms for converting some of that energy into work. In many respects it is a peculiar engine in that the burning process is carried out quietly in each of the myriads of body cells without flame and flurry, and that an unusually large proportion of the energy liberated in this process can, upon occasions, be converted into work. Nevertheless, it is an engine, and calls for the same considerations as other more familiar types of engine. I have mentioned the supply of fuel and oxygen, I could add the replacement of worn parts and many other parallels, but the point I want to deal with is the inevitable liberation of heat by the body.

At rest, the average man would set free in twenty-four hours enough heat to raise four gallons of ice-cold water to boiling point. A navvy would produce about two and a-half dozen times this amount in twenty-four hours of his average life. Welcome as this fact is in temperate and cold countries, it becomes something of a burden in sub-tropical and tropical regions. To appreciate this we must consider some further peculiarities of the body.

Body Temperature.

Birds and mammals differ from other animals in keeping their body temperature at a more or less fixed level. For birds and mammals the production of heat is no longer an incidental in life, nor can they leave the opposite process of heat loss to the chance determination of their surroundings. A single man whose wants in life are few and simple may find it possible to live without considering either his income or his expenditure, but a man burdened with the full responsibilities of citizenship knows only too well that to maintain a steady level of affluence he must exercise the strictest control over both. Just so does the human body require to have control over both heat production and heat loss if it is to keep its temperature constant. Just why it is necessary and how it came about is another story, but we shall have to be content, for the moment, with accepting the fact that the body, to work efficiently, must keep a fairly constant internal temperature of 99 deg. F.

Now, how does the body balance its income and expenditure in the matter of heat? It may seem strange at first if I tell you that, except in very cold weather, the body exercises but little control over heat production. Most of its attention is given to regulating the opposite process of heat loss. It is because of this concentration upon regulating heat-loss that the different climatic factors—temperature, humidity and wind velocity—are of such individual importance. If I am to make myself clear in succeeding articles I must take you a little way into the theory of heat loss.

How the Body Loses Heat.

Heat is lost from the body partly by *radiation*, and partly by *conduction* to surrounding objects cooler than the body. (The difference between these is that conduction requires some material connection with the objects concerned as by air, water, or touch, while radiation does not.) Still more heat can be lost if water is present on the surface of the body and if this can be *evaporated*. A fourth process of *connection*, or movements in the substance surrounding the body (e.g., air movements), helps conduction and often, also, evaporation.

It will be obvious to you that the body can lose heat by radiation and conduction only if the objects around it are cooler than the body itself, and it will appear reasonable to state that, the greater the difference in temperature the more rapid the loss. Thus in winter the body has no trouble whatever in getting rid of all the heat it is producing, just as you and I have no trouble in getting rid of the money we make; in fact, the difficulty is to keep enough in hand. In mild weather, as in good times, it is fairly easy to keep a reasonably steady balance. In hot weather, on the other hand, the body may encounter considerable difficulty in getting rid of all the heat it produces—I am told there are people who experience difficulty in getting rid of the money they make!

It is when the hot weather comes that the human body can make use of something it has kept up its sleeve, as it were—perspiration. At all times there is a certain amount of evaporation going on from the lungs and from the skin surface, but this does not constitute a very large proportion of heat loss in cold weather. As we all know, however, perspiration can be profuse in hot weather, and thus provide ample water for evaporation with consequent loss of heat. One is apt to forget, however, that it is not the sweat which forms big drops on our arms and face, nor the sweat that soaks the arm-pits that is losing heat for us. Visible sweat is largely wasted sweat. It is the sweat that is evaporated before we see it that is so useful. In technical terms, each gram of sweat evaporated gets rid of 540 calories of heat, while each gram of sweat that runs off the body gets rid of only 3 calories. In hot dry climates it is not the rule to see the limbs bathed in free sweat, while that is common enough in the humid tropics; yet simple weighing experiments will show that one loses twice as much sweat by evaporation in the hot dry as in the hot wet climate. One's thirst sensations confirm this.

Evaporation, however, can only take place into air that is not yet saturated with water vapour. In the dry climates, the air contains very little moisture, so that evaporation goes on very readily. It is just as well that this is so, since in those climates, heat loss by radiation and conduction is reduced to a very low figure, if not actually reversed. In humid climates, evaporation is very much more difficult and the air in contact with the body is quickly saturated, so that it must be constantly changed if evaporation is to go on. It is in humid climates that convection or air-movement is so important.

I think you will agree after this little discussion, which, I hope has not been too technical, that the difficulty the body is up against in the tropics is that of losing heat as rapidly as it is producing heat, and that the difficulties are of three main kinds:—

(i.) The surroundings are not sufficiently cooler than the body to permit of sufficiently rapid heat loss by radiation and conduction (in fact, the flow of heat is at times reversed!).

(ii.) The atmosphere may be so humid that evaporation cannot take place at any great rate.

(iii.) The air in contact with the skin surface may not be replaced sufficiently often so that it becomes saturated with heat and moisture, preventing further loss from the body.

Now these three factors—temperature, humidity and air-movement—are the three cardinal features of tropical climate, and, in turn, of tropical hygiene in so far as it concerns climate. So important are they, and so necessary is an understanding of them, that I shall consider them carefully in the next two articles. I have largely finished with general technical discussions, and shall pass on to more practical points, but, unless you are already familiar with these things, it would be a good plan to put this article aside for reference should some point escape you later.

KEEP COWS IN CONDITION.

There is as much variation in the skill of men in handling cows as there is among cows or men. It is folly to expect improvement in the production of cows unless there is first an improvement in the practices of men who feed and care for the cows.

At this particular time it would be easy to pick out two classes of dairymen by the condition of their herds. One group has found by experience that it pays to keep cows in good condition, and especially to have them in good condition at calving time. The other group, not being alive to the necessity of supplying plenty of the right kind of feed at the right time, and, further, apparently thinking that cows need be fed only while they are giving milk, have cows whose condition is anything but satisfactory at the beginning of a new lactation period. These are the men who should make some improvement in their skill in feeding and caring for cows, if the cows are to make them as much money as they are capable of making.

Pastures have been unusually short in many parts of the State. This means that a lot of cows will not be in proper condition to calve and carry on their next lactation period. There is still time to give these cows a fair chance to make good before they actually settle down to their milk-making task.

Good dairy cows should have from six to eight weeks' rest between the close of one lactation period and the beginning of the next. More than this, they should be fed well enough to permit them to regain what condition they have lost on account of the short pasture. It is a very difficult matter to feed them back to condition after they have calved.

The advice given is:—Look over your cows now and pick out those that need some extra feed, and, most important of all, give it to them. Calving troubles, retained afterbirth, premature calving, are costly. A cow that has trouble in calving will be off at least a fourth for that lactation period. Many of these troubles are due to ill condition, and can be corrected by proper care before calving.—L. VERNEY, Inspector of Dairies.

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.

Elephant Grass.

A.E. (Esk)—

It is rather difficult to be sure of grasses from a single leaf only, but the one sent by you seems to be definitely elephant grass, *Pennisetum purpureum,* a grass cultivated to a fair extent in Queensland and fed to cattle both as chaff and feeding off. We have no records of animals being poisoned by it, and tests by the Agricultural Chemist for the presence of a prussic-acid-yielding glucoside, as in the sorghums, have always given negative results. Perhaps your fowls are getting at some other green-stuff.

White Passion Fruit Vine.

J.H.G. (Woodford)—

Feeding experiments with the white passion fruit vine were carried out by the late Dr. Sydney Dodd at the Animal Health Station, Yeerongpilly. A feature brought out by the investigation was that the poisonous property of the vine is of a cumulative nature, and quite considerable quantities of it have to be eaten before any ill-effects are noticed. Most of the trouble occurs at times when grass is scarce, particularly towards the end of spring and the beginning of summer. Ordinary paddock stock running on well-grassed paddocks which may be infested with the vine do not seem to become affected, or at least not to any extent. It is the leaves that do the damage. It does not matter whether the plant is in fruit or not.

We have some other passion fruit vines possessing a prussic-acid-yielding glucoside, and which may cause the death of cattle that eat heavily of them very quickly. These, however, are not anything like so common as the ordinary white passion vine, the one experimented with by Dr. Dodd.

Scrub Panicum. Caustic Creeper.

"ENQUIRER" (Spring Creek Station)—

1. *Setaria australiensis,* sometimes called scrub panicum, a fairly common grass in parts of Queensland, mostly on the coast or near-coast and very common along scrub edges—hence the local name. It should be quite a good fodder, particularly in its younger stages, as it is very closely related to such well-known cultivated fodders as the giant setaria and the dwarf setaria.
2. *Euphorbia Drummondii,* the caustic creeper. This plant is very common at times in parts of Queensland, particularly on the Darling Downs country. It is reputedly poisonous to sheep, causing the head and neck to swell. If the swelling is pierced an amber-coloured fluid exudes and the life of the sheep may be saved. Most of the trouble occurs with travelling or freshly untrucked sheep; ordinary paddock sheep generally remain unaffected.

A Suspected Plant.

M.I. (Rockhampton)—

The specimen represents *Terminalia porphyrocarpa.* This plant as far as we know has not come under suspicion as a poisonous plant before, but an allied species known as yellowwood, namely *Terminalia oblongata,* which is very common in the Emerald district, has been proved by feeding tests to be harmful to sheep. Sheep fed on this species are said to become very poor in condition and to take fits, the symptoms being that the sheep drops in its tracks as though stunned, and lies trembling and rigid with extensor muscles of the neck and limbs strongly contracted. The sheep sometimes lies quite prone and sometimes props itself up and sways its head from side to side. The attack lasts from ten to forty seconds and the recovery is quick. The sheep struggles to its feet and stands for a few seconds swaying unsteadily, and then runs on to join the mob. The opinion is that when death resulted it was caused more by the indigestibility of the leaves than by any toxic character which produced the nervous disorder referred to.

Plants Suitable for the Upper Burnett.

S.G. (Mulgeldie)—

Following is a list of trees which should be worth while trying in your locality. The selection is confined to trees procurable through the ordinary nursery channels. The Botanic Gardens, Brisbane, are now under the control of the Brisbane City Council, and this Department has no young plants for distribution.

Celtis sinensis, Chinese celtis. This tree does remarkably well on the Darling Downs and is now being planted more or less extensively in the Burnett district. This tree is naturalised along the river at Gayndah, and you should be able to obtain seed from there. Seedlings often come up in such places under the parent trees. The leaves are good fodder for stock.

Bottle Tree, *Sterculia rupestris.*

Kurrajong, *Sterculia diversifolia.*

White Cedar, *Melia dubia.*

Camphor Laurel.

Figs.—Most of the varieties should do, particularly the Moreton Bay fig, or, preferably, the small-leaved Moreton Bay fig. The weeping fig is a fine tree, but if frosts are severe it may be badly cut back in winter.

Phytolacca (bellasombra). We notice you have tried this, but say it has not done too well. This is hard to understand, for in localities like yours this tree generally makes very rapid growth.

Silky Oak.

Coral Tree (*Erythrina*). Several varieties are in cultivation in Queensland.

A "Wild Lucerne."

T.C. (Chinchilla)—

The specimen represents *Psoralea patens,* a leguminous plant sometimes called wild lucerne, a vernacular, however, rather loosely applied in Queensland. Various species of *Psoralea* are very common in Queensland pastures, and are not known to possess any poisonous or harmful properties. Some are looked on as excellent fodder.

Wild Lettuce.

J.R. (Yeerongpilly)—

Your specimen represents a species of wild lettuce (*Lactuca*), probably *Lactuca scariola,* the prickly lettuce. The wild lettuces are sometimes regarded as poisonous to stock, but to what extent they are actually poisonous it is hard to say. Normally speaking, they are never eaten in sufficient quantities to cause trouble. In large quantities they are said to produce intoxication similar to that caused by poppy heads.

Two Common Herbs.

I.W.S. (Columboola)—

(1) *Euphorbia Drummondii,* caustic creeper, a very common herb in Western Queensland. It is reputedly poisonous to sheep, the symptoms given by experienced sheepmen being that the head and neck of affected animals swell very considerably. If the swelling is pierced an amber-coloured fluid exudes and the life of the sheep may be saved.

In New South Wales, where the plant also grows, a prussic-acid-yielding glucoside has been isolated from it, but the symptoms, as given by experienced sheepmen in Queensland, are certainly not those of prussic acid poisoning, and all tests with the Queensland plant so far have yielded negative or doubtful results. So far as we have observed, ordinary paddock or resting sheep are not affected by the plant, and commonly eat it freely without any ill effects following. Most of the trouble occurs with sheep that have been freshly untrucked, or are travelling, and have been allowed to eat large quantities of the plant.

(2) *Phyllanthus maderaspatanus,* a very common herb in Western Queensland, of which we have no particular knowledge as to its properties. It is probably eaten along with other herbage, but of its value or otherwise we are not very certain. Although it is a very common plant, we have not heard a local name for it.

General Notes

Staff Changes and Appointments.

Mr. J. W. Moy, Inspector of Stock, Toowoomba, has been appointed also an inspector under the Brands Acts.

Mr. C. W. Winders, B.Sc. Agr., Assistant (Agronomy), Department of Agriculture and Stock, has been appointed Assistant Agrostologist, Department of Agriculture and Stock.

Mr. A. R. Brimblecombe, Assistant to Entomologists, has been appointed Assistant Entomologist, Department of Agriculture and Stock.

Mr. C. G. Hughes, B.Sc. Agr., Assistant to Pathologist, Bureau of Sugar Experiment Stations, has been appointed Assistant Pathologist, Bureau of Sugar Experiment Stations.

Mr. L. Wood, Field Assistant, Department of Agriculture and Stock, Toowoomba, has been transferred to Brisbane.

Mr. R. J. Roache, Land Agent, Goondiwindi, has been appointed also an acting inspector of stock.

Mr. Percy Booth, "Yarrabine," Brooweena, has been appointed an hororary ranger under the Animals and Birds Acts.

Mr. A. M. Richardson, Inspector, Diseases in Plants Acts, will be transferred from Stanthorpe to Toowoomba.

Messrs. D. H. G. McIntosh (Tansey, via Goomeri), and H. Irving (Brandon), have been appointed Honorary Rangers under the Animals and Birds Acts.

Commodity Boards.

Regulations have been issued under "*The Primary Producers' Organisation and Marketing Acts*, 1926 *to* 1935," "*The Fruit Marketing Organisation Acts*, 1923 *to* 1934," "*The Dairy Products Stabilisation Acts*, 1933 *to* 1936," and "*The Wheat Pool Acts*, 1920 *to* 1930," prescribing the form of receipts and money forms issued in connection with the Council of Agriculture and commodity boards, the Committee of Direction of Fruit Marketing and other bodies, the Dairy Products Stabilisation Board, and the Wheat Board.

Animals and Birds Sanctuary.

Rita Island and the foreshores of the Burdekin River, and Ana Branch, near Ayr, have been declared a sanctuary under the Animals and Birds Acts.

Wandoan Tick Infested Area.

An Order in Council has been issued under the Diseases in Stock Acts declaring an area in the vicinity of Wandoan to be an infested area for the purposes of the Acts. For some years past, this particular country, which extends roughly from Wandoan to Clifford Holding, has been practically free from ticks, and stockowners in the area attempted to keep their stock tick-free. It is understood that the area is now thoroughly fenced, and by declaring it to be an effected area, stockowners will be protected as cattle will not be allowed to enter the infected area until they have been dipped at least twice and found free from ticks. By making this particular section an infected area, it will be an additional safeguard to the clean country on the Downs south of the Main Range.

Atherton Tableland Maize Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts, extending the boundaries of the present district in North Queensland in which maize has been declared to be a commodity, namely, the Petty Sessions Districts of Atherton, Herberton, and Chillagoe (as defined at the time of the issue of the Order in Council constituting the Atherton Tableland Maize Board —31st August, 1923) to include all that locality which is contiguous to and is distant not more than fifty miles from a boundary of the said Petty Sessions Districts, and the Atherton Tableland Maize Board is extended to include the growers of maize in this additional locality.

Rural Topics

Entire Corn Cob as Stock Food.

The maize cob core has a very low feed value, and is digested with difficulty by animals, owing to its rubber-like consistency. In fact, if the cob core is not finely ground, animals will refuse to eat it, and if means for the grinding of the core are not available the feeding of the cob core with the corn grain is not advisable.

The grinding of the cob core requires considerable power and, therefore, cost of grinding has to be taken into consideration. The digestible crude protein content of the corn cob core is about 0.4 per cent., whereas the quantity of digestible crude protein in the corn grain ranges from 6 to 8 per cent. When the whole cob (core and grain) is ground to form what is called corn and cob meal the digestible crude protein of this meal will be considerably lower than that of the corn grain; the corn and cob meal may contain from 3.75 to 6 per cent. digestible protein. This variation in the digestible crude protein of the corn and cob meal is due to the fact that in different varieties of maize the proportion of core to grain ranges from 20 to 40 per cent.

In connection with the foregoing, it is considered that if there is a shortage of cheap roughage the grinding of the core of the cob with the grain will be of advantage; but when there is an abundance of roughage (hay, grass roughage, &c.) and an addition of concentrates (maize, &c.) is required to make a balanced ration with such roughage, it is then inadvisable to grind the core of the cob with the grain.—E. H. GURNEY, Agricultural Chemist.

Brigalow Foliage as Fodder.

Brigalow foliage, other than young shoots, has never been regarded as of value for stock in times of shortage owing to its unpalatability. There is, however, a variety which has not been separated botanically and which is not only acceptable to stock, but suggests, on analysis, a fodder value superior to that of mulga. This variety differs from the ordinary brigalow in leaf characteristics only. Its leaves are narrower and longer, and light green rather than silvery in colour. It occurs here and there in pure brigalow stands, as well as when the brigalow is interspersed with belah, but is thought to be more common in stands of less density where eucalypts also occur.

A sample for analysis was obtained at Chinchilla, close to the Condamine River. The analysis of mulga foliage is given for comparison, both being of water-free material:—

	Narrow-leaved Brigalow.	Mulga.
	Per cent.	Per cent.
Protein	13.9	11.1
Carbohydrates	54.6	55.9
Fat	2.5	3.2
Fibre	24.1	25.4
Ash	4.9	4.4

N. A. R. POLLOCK, Senior Instructor in Agriculture.

Essentials in Dairy Farm Lay Out.

There are two necessary adjuncts to a dairy farm which are often looked for in vain, namely, a crush and an isolation paddock.

A crush is necessary for the handling of bulls and young stock, but only a few farms are equipped with one.

An isolation paddock is a most necessary feature, but is conspicuous by its absence on nearly every dairy farm.

How many diseases could be checked if a farmer had a good isolation paddock in which he could place and watch a suspected animal, without any danger of the animal coming into contact with the rest of the herd?—S. E. PEGG, Inspector of Dairies.

Giant Setaria—An Attractive Crop.

The attention of farmers is once more called to the fact that certain crops offer attractive possibilities, and can be raised rapidly and at little cost, coincident with a change to normal seasonal conditions. At present *Setaria italica*, or so-called panicum seed, and preferably the giant variety, is proving an attractive crop for farmers who have land already prepared for sowing. The present price, *e.g.*, from £22 to £25 per ton, is very attractive, but naturally will recede as harvesting operations commence.

This is a crop which can be sown, with safety, up to the middle of January and probably even later, where suitable conditions obtain. The requirements of the Commonwealth, it is understood, for this class of grain are in the vicinity of 2,500 tons per annum.—A. E. GIBSON, Director of Agriculture.

Cream Supplies during Summer.

During the summer months when extreme heat conditions are common the necessity should be stressed for frequent and early deliveries of cream supplies to butter factories. Daily delivery of cream to the factories is an ideal difficult to attain in certain areas, but nothing less than four times a week delivery should be the rule from October to March, inclusive.

The practice of holding up supplies and delaying the cream carrier for the purpose of making certain that that morning's cream goes with the supply of cream obtained previously, should be discouraged. More harm than good is sometimes done to the cream supply through the practice of mixing the newly produced warm cream with the older and cooler cream. This practice is not infrequently the cause of cream being graded down on delivery at the factory platform.

Dairymen would be well advised to have their cream ready for the cream carrier on each morning of delivery. Should the morning's cream not be cooled down and ready on time, that particular cream should be held back for the next delivery, and, if this is done, better results will be obtained on arrival at the factory.

It has been reported that a number of dairymen make a practice of holding up the cream carrier for the purpose abovementioned, and even were this not detrimental to their own cream supply it is a selfish attitude to take up, in so far as neighbouring dairymen are concerned who desire their cream to arrive at the factory as early as possible.

With the advent of summer, the attention of all dairymen is directed to the necessity of supplying a cream with a butterfat content of not less than 38 per cent.

A sound slogan for all cream suppliers during the summer is: " Frequent and early delivery and test around forty."—A. HASSACK, Inspector of Dairies.

Sugar-Cane Varieties for Southern Queensland.

Those growers who have not yet experienced the benefits from growing the new gum-resistant canes, which have recently become so popular in Southern Queensland, are urged to include some in their present planting. The results from all trials harvested to date indicate that Co. 290 will far outyield all other varieties on practically all types of soil. It generally gives a fair c.c.s. value, while at times very good returns are reported. On damp alluvial lands it tends to maintain continuous growth, and with an "open" winter, heavy cane tonnages with low c.c.s. might result. Such conditions constitute but a small proportion of the lands on which the variety could be planted.

For all-round performance, P.O.J. 2878 is strongly to be recommended. For vigour of growth and drought resistance, it definitely excels, and as a standard cane it has no equal. This is a most important feature, as it enables the Southern grower, on frost-free areas, to revert to the "two-year cropping" methods, which were so popular before gumming disease took its toll, and which enable the grower to effect such a substantial lowering of costs of production. In these times, when excessively large crops demand that a proportion of the cane be stood over, no cane responds so satisfactorily in its second year of growth as a ratoon crop of this variety.

P.O.J. 2725 is a cane which has shown remarkable yields where moisture conditions are suitable, and it is definitely a valuable cane for irrigated land. Near the coast, it exhibits an unfortunate tendency to arrow early, which is a detriment if the farmer is obliged to standover the crop.—A. F. BELL, Bureau of Sugar Experiment Stations.

Orchard Notes

MARCH.

THE COASTAL DISTRICTS.

IF the weather is favourable, all orchards, plantations, and vineyards should be cleaned up, and the ground brought into a good state of tilth so as to enable it to retain the necessary moisture for the proper development of trees or plants. As the wet season is frequently followed by dry autumn weather, this attention is important.

Banana plantations must be kept free from weeds, and suckering must be rigorously carried out, as there is no greater cause of injury to a banana plantation than neglect to cultivate. Good strong suckers will give good bunches of good fruit, whereas a lot of weedy overcrowded suckers will only give small bunches of undersized fruit that is hard to dispose of, even at a low price.

Cooler weather may tend to improve the carrying qualities of the fruit, but care must still be taken to see that it is not allowed to become over-developed before it is packed, otherwise it may arrive at its destination in an over-ripe and consequently unsaleable condition. The greatest care should be taken in grading and packing fruit. Only one size of fruit of even quality must be packed. Smaller or inferior fruit must never be packed with good large fruit, but must always be packed separately as required by regulation.

During recent weeks there has been a marked increase in the banana thrips population in those districts in which this pest is well established. Growers who consider it necessary to deal with banana thrips are advised that so far nicotine dusts applied at weekly intervals have given the most promising results. The dusts may be applied by means of an inexpensive hand dust gun, or by a rotary duster to which a special flexible outlet pipe has been fitted.

The marketing of the main crop of pineapples, both for canning and the fresh fruit trade, will be completed in the course of the month, and as soon as the fruit is disposed of plantations, which are apt to become somewhat dirty during the gathering of the crop, must be cleaned up. All weeds must be destroyed, and if blady grass has got hold anywhere it must be eradicated, even though a number of pineapple plants have to be sacrificed, for once a plantation becomes infested with this weed it takes possession and soon kills the crop. In addition to destroying all weed growth, the land should be well worked and brought into a state of thorough tilth.

In the Central and Northern districts, early varieties of the main crop of citrus fruits will ripen towards the end of the month. They will not be fully coloured, but they can be marketed as soon as they have developed sufficient sugar to be palatable; they should not be gathered whilst still sour and green.

As blue mould is likely to cause heavy loss in coastal citrus, especially in long distance consignments, special precautions should be taken for minimising this loss. It must be remembered that the blue mould fungus will only attack bruised or wounded fruit. Hence it is necessary to be careful that no injuries are given by the clippers or finger nails during picking. Fruit should be cut and not pulled. Long stalks which may injure other fruit must be avoided.

The fruit must be carefully handled and accurately packed so as to avoid bruising. Any injured fruit should be discarded. In order to reduce the number of fungus spores present in the plantation all waste fruit in the orchard or packing shed should be collected at frequent intervals and destroyed by fire or burying.

Fruit must be carefully graded for size and colour, and only one size of fruit of one quality should be packed in one case. The flat bushel-case (long packer) commonly used for citrus fruits does not lend itself to up-to-date methods of grading and packing, and we have yet to find a better case than the American orange case. Failing this case, a bushel-case suggested by the New South Wales Department of Agriculture is the most suitable for citrus fruits, and were it adopted it would be a simple matter to standardise the grades of our citrus fruit, as has been done in respect to apples packed in the standard bushel-case used generally for apples throughout the Commonwealth. The inside measurements of the case suggested are 18 in. long, 11$\frac{3}{4}$ in. wide, and 10$\frac{1}{2}$ in. deep. This case has a capacity of 2,200 cubic inches, but is not included in the schedule of the regulations under "*The Fruit Cases Acts*, 1912-1922." The half-bushel case, No. 6 of the Schedule above referred to, is

10 in. by 11¾ in. by 5¼ in. inside measurements with a capacity of 1,100 cubic inches. The case should be suitable for oranges and the half-case for mandarins. No matter which case is used, the fruit must be sweated for seven days before it is sent to the Southern markets, in order to determine what fruit has been attacked by fruit fly, and also to enable bruised or injured fruit liable to blue mould to be removed prior to despatch.

Growers are reminded that the control of the bronze orange bug is best achieved by spraying with the resin-caustic soda-fish oil mixture normally either late in March or early in April. Applied at this time of the year the spray can give a mortality of 98 per cent. of the bronze bugs, which are then present solely in the very young stages. This spray is also very effective against several of the important scale insects infesting citrus.

Red scale is a pest to which citrus growers will shortly have to give attention, it being considered that control is best established from the middle of March to early in April. Fumigation with hydrocyanic acid gas is most effective against red scale, but success may also be achieved with white oils or with the resin-caustic soda-fish oil mixture evolved for the control of the bronze orange bug. Red scale, of course, is pre-eminently a pest of the hotter drier citrus districts.

Strawberry planting may be continued during the month, and the advice given in last month's notes still holds good. Remember that no crop gives a better return for extra care and attention in the preparation of the land and for generous manuring than the strawberry.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

THE advice given in these notes for the last few months regarding the handling, grading, and packing of fruit should still be followed carefully. The later varieties of apples and other fruits are much better keepers than earlier-ripening sorts, and as they can be sent to comparatively distant markets, the necessity for very careful grading and packing is, if anything, greater than it is in the case of fruit sent to nearby markets for immediate consumption. Instruction in the most up-to-date methods of grading and packing fruit has been published by the Department, which advice and instruction should enable the growers in that district to market their produce in a much more attractive form.

The same care is necessary in the packing of grapes. Those who are not expert cannot do better than follow the methods of the most successful packers.

As soon as the crop of fruit has been disposed of, the orchard should be cleaned up, and the land worked. If this is done, many of the fruit-fly pupæ that are in the soil will be exposed to destruction in large numbers by birds, or by ants and other insects. If the ground is not worked and is covered with weed growth, there is little chance of the pupæ being destroyed.

Where citrus trees show signs of the want of water, they should be given an irrigation during the month, but if the fruit is well developed and approaching the ripening stage, it is not advisable to do more than keep the ground in a thorough state of tilth, unless the trees are suffering badly, as too much moisture is apt to produce a large, puffy fruit of poor quality and a bad shipper. A light watering is therefore all that is necessary in this case, especially if the orchard has been given the attention recommended in these notes from month to month.

* * *

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Farm Notes

MARCH.

LAND on which it is intended to plant winter cereals should be in a forward stage of preparation. Sowings of lucerne may be made at the latter end of the month on land which is free from weed growth and has been previously well prepared.

The March-April planting season has much in its favour, not the least of which is that weeds will not make such vigorous growth during the succeeding few months, and, as a consequence, the young lucerne plants will have an excellent opportunity of becoming well established.

Seed wheat should be treated with copper carbonate for the control of bunt. For oats and barley seed the use of formalin or a reliable mercury dust is advisable.

Potato crops should be showing above ground, and should be well cultivated to keep the surface soil in good condition; also to destroy any weed growth.

In districts where the potato crop is subject to Irish blight it is advisable to spray the plants for the control of this disease. Bordeaux mixture of 4.4.40 strength should be applied at least three times at intervals of ten days to a fortnight, commencing when the plants are about six weeks old.

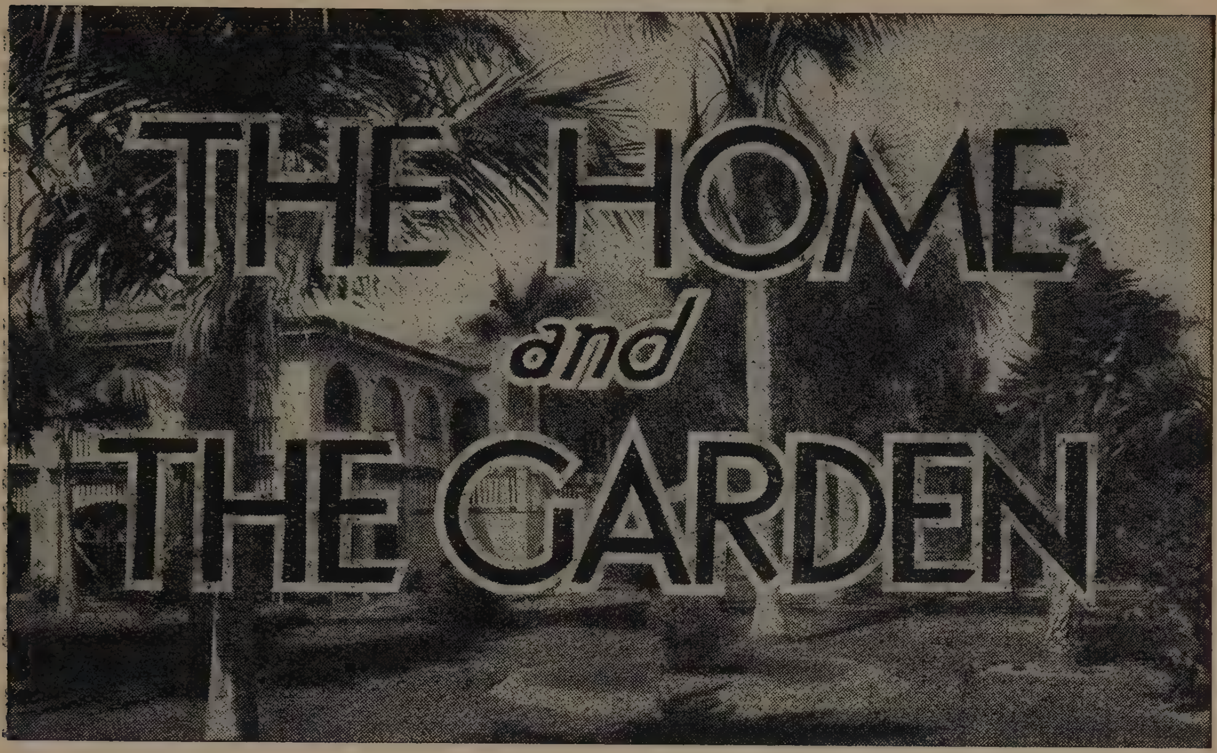
Maize crops which have fully ripened should be picked as soon as possible and the ears stored in well-ventilated corn cribs, or barns. Selected grain which is intended for future seed supplies should be well fumigated for thirty-six hours and subsequently aerated and stored in airtight containers. The germination of the maize is not normally affected by this treatment if dry and mature when treated.

The following crops for pig feed may be sown:—Mangel, sugar beet, turnips and swedes, rape, field cabbage, and carrots. Owing to the small nature of the seeds, the land should be worked up to a fine tilth before planting, and should contain ample moisture in the surface soil to ensure a good germination. Particular attention should be paid to all weed growth during the early stages of growth of the young plants.

As regular supplies of succulent fodder are essentials of success in dairying operations, consideration should be given to a definite cropping system throughout the autumn and winter, and to the preparation and manuring of the land well in advance of the periods allotted for the successive sowings of seed.

The early-planted cotton crops should be now ready for picking. This should not be done while there is any moisture on the bolls, either from showers or dew. Packed cotton showing any trace of dampness should be exposed to the sun for a few hours on tarpaulins, bags, or hessian sheets, before storage in bulk or bagging or baling for ginning. Sowings of prairie grass and *Phalaris bulbosa* (Toowoomba canary grass) may be made this month. Both are excellent winter grasses. Prairie grass does particularly well on scrub soil.

Dairymen who have maize crops which show no promise of returning satisfactory yields of grain would be well advised to convert these into ensilage to be used for winter feed. This, especially when fed in conjunction with lucerne or cowpea, is a valuable fodder. Where crops of Soudan grass, sorghum, white panicum, Japanese millet, and liberty millet have reached a suitable stage for converting into ensilage, it will be found that this method of conserving them has much to recommend it. Stacking with a framework of poles, and well weighting the fodder, is necessary for best results. All stacks should be protected from rain by topping off with a good covering of bush hay built to a full eave and held in position by means of weighted wires.



OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

MEAN WHAT YOU SAY.

IT is most important that parents should mean what they say in dealing with their children, and that the children should know this. It is worse than useless to allow a child to do something one day and punish him for doing the very same thing next day. How is he to know what to expect? Last week mother did not allow him to play out on the street, but one day the week before she did. Naturally, being a clever, reasonable child, he thinks he will risk it again. Mother may not punish him.

Bribes and threats are wrong means of teaching a child to obey. If you tell a child that you will give him something nice if he does what you ask you are bribing him, and before long you will find he will do nothing unless he gets something out of it.

Very few of the parents who threaten their children mean what they say. A mother may say to her naughty child: "I will ask the policeman to come and take you to gaol." She knows it is not true. At first her threat frightens the child; then he learns that it is not true, and before long he takes no notice. Threats may turn him into a coward; every mother who wants her child to be brave should avoid them. On the other hand, if the threats are never carried out the child may grow indifferent. It is best never to threaten.

Children do not obey people whom they cannot trust, and parents who break promises to their children cannot expect to be trusted or obeyed by their children.

Speak Quietly.

Here is another point. When your child is not obedient do you become angry and raise your voice? That excites the child, and some children like such excitement very much. They will even do things they know are naughty just for the sake of seeing mother lose her temper. If parents can manage not to get angry they will find it much easier to teach their children to be obedient. Loud talking is a strain to listen to, and is bad both for children and for grown-ups. It makes the home noisy; noise makes everyone in the home nervous and irritable. Parents who always speak quietly find that their children will listen to them more willingly.

Be Reasonable.

A toddler's doings, which seem so trivial to many grown-ups, are really very important indeed to him; and the things that grown-ups think so very important mean nothing at all to him. He does not think, for example, it is important to give up his play and come to dinner as soon as he is called.

It is a good plan to allow the child a few minutes to finish what he is doing before you expect him to obey a command. Let him have five minutes' grace before mealtime and before bedtime, for instance. There are some things little children really cannot do, and yet they are often asked to do them—for instance, to sit still for a long time, to keep from making a noise for a long time. It is not fair to expect little children to do these things, which adults can, of course, do quite easily. The child's muscles are too busy growing to allow him to sit still for a long time. They need constant exercise—by wriggling and other means which sometimes annoy tired mothers—in order to grow. Only an adult, whose muscles have reached their final stage of growth, can discipline his muscles so that he can sit still for a long time. And making a noise is a part of the business of growing. The toddler's chattering and shouting are just as important to healthy growth as is the lusty crying of the healthy infant.

It is not really hard to teach a child to obey the first time you speak if you always speak quietly, never angrily; if you let the child find by experience that everything is pleasant when he takes notice quickly but not so pleasant if he does not obey. When the little child is good and obedient it is right for mother to show that she is pleased to allow some little treat.

Teach Children to Think for Themselves.

If people are to be happy when they grow up they must have learned to obey certain rules when they were children; but they must have learned to think for themselves. Children must be taught to think for themselves what is right for them to do. There are children who never do anything by themselves. They never think for themselves. They have to wait until someone tells them what to do. When they grow up they are very unhappy because they cannot be independent.

Let us teach our children to think for themselves, encourage them when they plan to do things without help, when they attempt to fasten their own shoes, to put on their own socks, to do up their buttons, to wash their faces. They may seem to be getting on very slowly. It takes time to let them make the effort to help themselves, but try to be patient while they accomplish what they are trying to do. Praise them for trying to help themselves. It will be all the better for them if they learn to be independent, and in the long run all the better for mother.

IN THE FARM KITCHEN.

PINEAPPLES FOR SUMMER DISHES.

Following are some recipes which reveal pineapple in a new light:—

Pineapple Meringue.

Take 1 pineapple, ¼ lb. sugar, ½ pint water, 4 oz. crystallised fruits, 4 egg-whites, ½ lb. castor sugar, 6 meringues, 1 tablespoonful sherry, ¼ pint whipped cream, cochineal.

Boil the founr ounces of sugar and the water together till thick syrup, mince crystallised fruit very finely, pour syrup on to fruit, let it get cold, peel pineapple, core the centre, add sherry to syrup, fill pineapple with mixture, putting fruit in centre and syrup last of all. Whip egg-whites very stiffly, add castor sugar, put in a forcing bag with rose pipe, and cover the pineapple with it, stand on a baking sheet in oven until meringue is quite set, then take out and stand on a glass dish, pour remainder of syrup on the fruit in the centre, place in the hole the pineapple-top, neatly trimmed, fill meringues with whipped cream, coloured a delicate pink with a little cochineal, and pour the remainder of the cream round the base of the pineapple and arrange meringues on top.

Pineapple Sponge.

Take half grated pineapple, ½ oz. gelatine, 2 egg-whites, 1 lemon, 2 oz. sugar, ½ pint custard, 1 tablespoonful sherry, crystallised fruits.

Soak the gelatine in about two tablespoonfuls water for one hour, dissolve over hot water with the juice of a lemon and sugar, add the pineapple, and stir all over the gas until thoroughly mixed. Add the sherry, and pour into a basin to slightly set, beat the egg-whites stiffly, and add to the fruit mixture, and whisk till firm. Stand on ice for a little while, then heap on a glass dish; pour custard round and garnish with crystallised fruits.

Pineapple Meringue Pie.

Take 1 ripe pineapple, ½ cupful sugar, 1 cupful thin cream, 3 eggs, pinch salt, 3 tablespoonfuls castor sugar, pastry.

Pare and remove the ‘‘ eyes ’’ from the pineapple, grate finely. Add the sugar, cream, egg-yolks beaten slightly, and a pinch of salt. Mix all well together and bake in a pie pan, lined with a good pastry, until firm in the centre. Whip the egg-whites very stiffly, and add the castor sugar and mix well. Spread the meringue on pie and return to oven to brown.

Pineapple Tartlets.

Take 1 small pineapple, 2 oz. castor sugar, ½ pint cold water, 3 oz. blanched almonds, 6 oz. shortcrust.

Pare and remove the eyes of the pineapple, then slice and core. Place in a saucepan. Add the sugar and water. Stir till boiling, then simmer for fifteen minutes. Drain, then boil syrup till thick. Cool. Line tartlet tins with shortcrust. Prick with a fork and bake in a hot oven for a quarter of an hour. Place a pineapple ring in each case. Cover with syrup. Decorate with almonds.

Pineapple Tarts.

Take 1 small pineapple, two-thirds of a cupful of sugar, juice ½ orange, ½ lemon, rind ½ orange, 1 egg-white, 1 tablespoonful castor sugar, pastry.

Pare and grate the pineapple, add the sugar, orange, lemon juice, and the grated orange rind. Cook slowly until mixture thickens. Prepare some small pastry shells, made in small patty-pans. Turn mixture into the pastry shells. Make a meringue with the egg-white and castor sugar, and pile in a pyramid on top of each. Return to the oven to brown delicately.

Pineapple Dainty.

Take 1 tin sliced pineapple, good ½ oz. gelatine, ½ cupful hot water, sugar to taste, some glace cherries, carmine.

Dissolve the gelatine in the hot water. Drain syrup from pineapple; add dissolved gelatine to syrup and water to make one pint of liquid. Add sugar to taste if required. Run a little of the jelly into the bottom of a plain mould, and when set place a slice of pineapple with a cherry in the centre. Pour over a little more jelly. When this is set, mask the sides of the mould with jelly and decorate with slices of pineapple and cherries. Chop the remainder of the pineapple and add to the jelly; add a few drops of carmine. Whisk well until thick and on the point of setting, then fill the prepared mould till set. Turn out on to a glass dish and serve with whipped cream if liked.

Pineapple Medley.

Take 1 large tin pineapple (sliced), 2 bananas, 1½ oz. almonds, 2 oz. glace cherries, 3 dessertspoonfuls orange juice, ½ oz. gelatine.

Drain the pineapple and put it through the mincer, keeping back three slices for decoration. Blanch and chop the almonds, cut up the cherries, and peel the bananas. Cut them into small dice. Dissolve the gelatine in a saucepan with half a gill of the pineapple juice, warmed, then strain it into the remainder of the juice and add the orange juice. Stir in the minced pineapple and other prepared fruits and almonds, then turn them into a mould which has been rinsed out with cold water. When quite set, unmould the medley and decorate it with whipped cream and the remainder of the pineapple.

Pineapple Lemonade.

Take 1 pineapple, 1 lb. castor sugar, 5 lemons, 3 pints water.

Carefully peel and grate the pineapple. Pour over it the strained juice of the lemons. Boil sugar and one pint of the water for ten minutes, stir syrup into the fruit juices, add one quart of cold water, then strain through fine muslin. Serve in glasses quarter-filled with cracked ice, adding a cherry to each glass.

Pineapple and Melon Jam.

Take 2 lb. pineapple, 4 lb. of the firm part of a sugarmelon, 3 lb. sugar.

Peel and cut into cubes the firm part of the melon. Peel and grate the pineapple with a fork. Put the fruit into a preserving pan and boil for three hours with half of the sugar, add the remainder of the sugar, and boil for one hour longer or until it jells.

Pineapple and Tomato Jam.

Take 3 large pineapples, 7½ lb. tomatoes, sugar.

Peel the pineapples, remove the " eyes " and chop up finely. Put the tomatoes into boiling water, so that the skins come off easily. Put the pineapple and tomatoes into a preserving pan and stew gently till the pineapple is soft. Then add three-quarters of a pound of sugar to each pound of mixture and boil till it is done. Let it cool a little before putting into the jars, which must be warm and perfectly dry.

◆

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RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF DECEMBER IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1936 AND 1935, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Dec.	No. of Years' Records.	Dec., 1936.	Dec., 1935.
North Coast.	In.		In.	In.
Atherton	7·22	35	11·34	1·21
Cairns	8·74	54	8·95	·62
Cardwell	8·21	64	12·22	·53
Cooktown	6·62	60	7·53	·12
Herberton	5·72	50	7·57	2·58
Ingham	6·92	44	12·98	1·04
Innisfail	11·79	55	16·77	1·36
Mossman Mill ..	10·31	23	15·04	·70
Townsville	5·49	65	7·03	·50
Central Coast.				
Ayr	3·95	49	8·16	·28
Bowen	4·38	65	10·29	·37
Charters Towers ..	3·28	54	3·56	·134
Mackay	7·09	65	10·25	·148
Proserpine	7·78	33	8·87	·312
St. Lawrence ..	4·77	65	3·93	·169
South Coast.				
Biggenden	4·71	37	5·19	4·58
Bundaberg	5·15	53	3·01	9·32
Brisbane	4·94	84	1·80	3·63
Caboolture	5·31	49	1·87	4·47
Childers	5·70	41	5·12	6·93
Crohamhurst	7·32	43	2·27	8·30
Esk	4·75	49	3·43	4·60
Gayndah	4·22	65	2·96	6·19
Gympie	6·08	66	3·76	6·57
Kilkivan	4·61	57	2·25	6·45
Maryborough ..	5·12	65	3·93	5·51
Nambour	6·93	40	1·38	4·97
Nanango	3·84	54	2·93	2·91
Rockhampton ..	4·35	65	2·64	5·85
Woodford	5·64	49	2·18	4·88

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Dec.	No. of Years' Records.	Dec., 1936.	Dec., 1935.
Central Highlands.	In.		In.	In.
Clermont	3·84	65	3·08	1·73
Gindie	2·82	37	..	2·97
Springsure	3·26	67	2·20	3·23
Darling Downs.				
Dalby	3·34	66	5·10	5·01
Emu Vale	3·51	40	3·35	2·40
Hermitage	2·95	30	..	3·18
Jimbour	3·28	48	5·56	2·92
Miles	3·16	51	3·38	2·56
Stanthorpe	3·58	63	5·59	3·34
Toowoomba ..	4·43	64	5·91	2·66
Warwick	3·42	71	5·72	3·55
Maranoa.				
Roma	2·54	62	4·96	2·08
State Farms, &c.				
Bungeworgorai ..	3·01	22	6·10	·95
Gatton College ..	3·75	37	8·69	5·29
Kairi	6·30	22	..	..
Mackay Sugar Experiment Station	8·07	39	10·55	1·66

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—DECEMBER, 1936.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Means at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.				Total.	Wet Days.
		Max.	Min.	Max.	Date.	Min.	Date.		
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·81	85	77	89	5, 21, 23, 24, 25, 26, 27, 29, 30, 31	73	3, 4	753	16
Herberton	..	81	64	90	2	59	15	705	17
Rockhampton	29·90	88	71	95	3	66	2	264	10
Brisbane	29·95	85	68	95	23	64	5	180	8
Darling Downs.									
Dalby	29·91	88	64	100	2	54	5	510	13
Stanthorpe	..	81	58	95	1	43	5	559	14
Toowoomba	..	83	61	96	2	49	5	591	12
Mid-Interior.									
Georgetown	29·83	93	72	100	22, 23,	67	15	1116	18
Longreach	29·82	98	71	106	23	61	5	128	9
Mitchell	29·86	90	68	101	1, 2, 3, 21	54	5	343	15
Western									
Burketown	29·80	94	76	100	24	65	5	703	11
Boulia	29·78	102	75	109	12, 23	60	5	64	3
Thargomindah	29·80	95	70	106	12	56	5	484	5

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	February, 1937.		March, 1937.		MOONRISE. Feb., 1937.	MOONRISE. Mar., 1937.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	5·26	6·47	5·46	6·24	9·49	8·23
2	5·26	6·46	5·46	6·23	10·24	8·59
3	5·27	6·46	5·47	6·23	11·1	9·38
4	5·27	6·45	5·47	6·22	11·42	10·12
5	5·28	6·44	5·48	6 21	..	11·8
					a.m.	
6	5·29	6·44	5·48	6·21	12·27	11·59
						a.m.
7	5·29	6·43	5·49	6·20	1·15	..
8	5·30	6·42	5·49	6·19	2·11	12·54
9	5·31	6·42	5·50	6·18	3·8	1·53
10	5·31	6·41	5·50	6·16	4·10	2·52
11	5·32	6·40	5·51	6·15	5·10	3·54
12	5·33	6·39	5·51	6·14	6·12	4·55
13	5·33	6·39	5·52	6·12	7·14	5·58
14	5·34	6·38	5·52	6·11	8·14	7·1
15	5·35	6·37	5·53	6·10	9·18	8·8
16	5·35	6·37	5·54	6 8	10·21	9·15
17	5·36	6·36	5·54	6·7	11·32	10·22
					p.m.	
18	5·37	6·35	5·55	6·6	12·36	11·27
						p.m.
19	5·37	6·34	5·55	6·5	1·37	12·28
20	5·38	6·33	5·56	6·4	2·30	1·23
21	5·39	6·32	5·56	6·3	3·21	2·11
22	5·39	6·31	5·57	6·2	4·12	2·54
23	5·40	6·30	5·57	6·1	4·54	3·33
24	5·41	6·29	5·58	6·0	5·33	4·8
25	5·42	6·28	5·59	5·59	6·8	4·41
26	5·43	6·27	5·59	5·57	6·41	5·16
27	5·44	6·26	6·0	5·56	7·14	5·49
28	5·45	6·25	6·0	5·54	7.47	6·22
29			6·1	5·53		6·59
30			6·1	5·51		7·36
31			6·2	5·50		8·17

Phases of the Moon, Occultations, &c.

3 Feb.	☽	Last Quarter	10 4 p.m.
11 ,,	●	New Moon	5 34 p.m.
18 ,,	☾	First Quarter	1 49 p.m.
25 ,,	○	Full Moon	5 43 p.m.

Apogee, 3rd February, at 10 p.m.

Perigee, 16th February, at 6 a.m.

The Moon will pass Jupiter on the 8th, Mercury on the 9th, and Saturn on the 13th, but in daylight and below the horizon.

Mercury rises at 3.39 a.m., 49 minutes before the Sun, on the 1st, and sets at 5.10 p.m., 1 hour 25 minutes before it; on the 14th it rises at 3.39 a.m., 1 hour 55 minutes before the Sun, and sets at 5.13 p.m., 1 hour 25 minutes before it.

Venus rises at 9.0 a.m., 3 hours 34 minutes after the Sun, on the 1st, and sets at 9.7 p.m., 2 hours 20 minutes after it; on the 14th it rises at 9.7 a.m., 3 hours 33 minutes after the Sun, and sets at 8.45 p.m., 2 hours 7 minutes after it.

Mars rises at 11.21 p.m. and sets at 12.30 p.m. on the 1st; on the 14th it rises at 10.49 p.m. and sets at 11.59 a.m.

Jupiter rises at 3.17 a.m. and sets at 5.2 p.m. on the 1st; on the 14th it rises at 2.38 a.m. and sets at 4.20 p.m.

Saturn rises at 8.21 a.m. and sets at 8.52 p.m. on the 1st; on the 14th it rises at 7.34 a.m. and sets at 8.38 p.m.

Although in this the shortest month of the year there are but few of the usual phenomena to record, and those not of great public interest, the wonderful display of the Northern constellations will compensate for the loss. Piloted across the sky by the most attractive little star group seen with the naked eye, the Pleiades, are the Hyades, with the red-glowing Aldebaran of Biblical fame, then Orion, in splendid attire, with two stars of first magnitude and five of the second, his belt inlaid "with patines of bright gold," and the short, gleaming sword. The Great Hunter is followed by Canis Major, with Sirius, flashing and scintillating in various colours, larger than any first magnitude star. Across in the south-east Canopus, in Argo, the second in rank among all stars, is most noticeable. Early in evening, when Venus, like a little Sun, lights up the western sky, the Southern Cross will be rising in the south-east, welcomed as warmly in the Southern Hemisphere as the Pleiades are in Northern lands.

5 Mar.	☽	Last Quarter	7 17 p.m.
13 ,,	●	New Moon	5 32 a.m.
19 ,,	☾	First Quarter	9 46 p.m.
27 ,,	○	Full Moon	9 12 a.m.

Apogee, 3rd March, at 6.0 p.m.

Perigee, 15th March, at 1.0 p.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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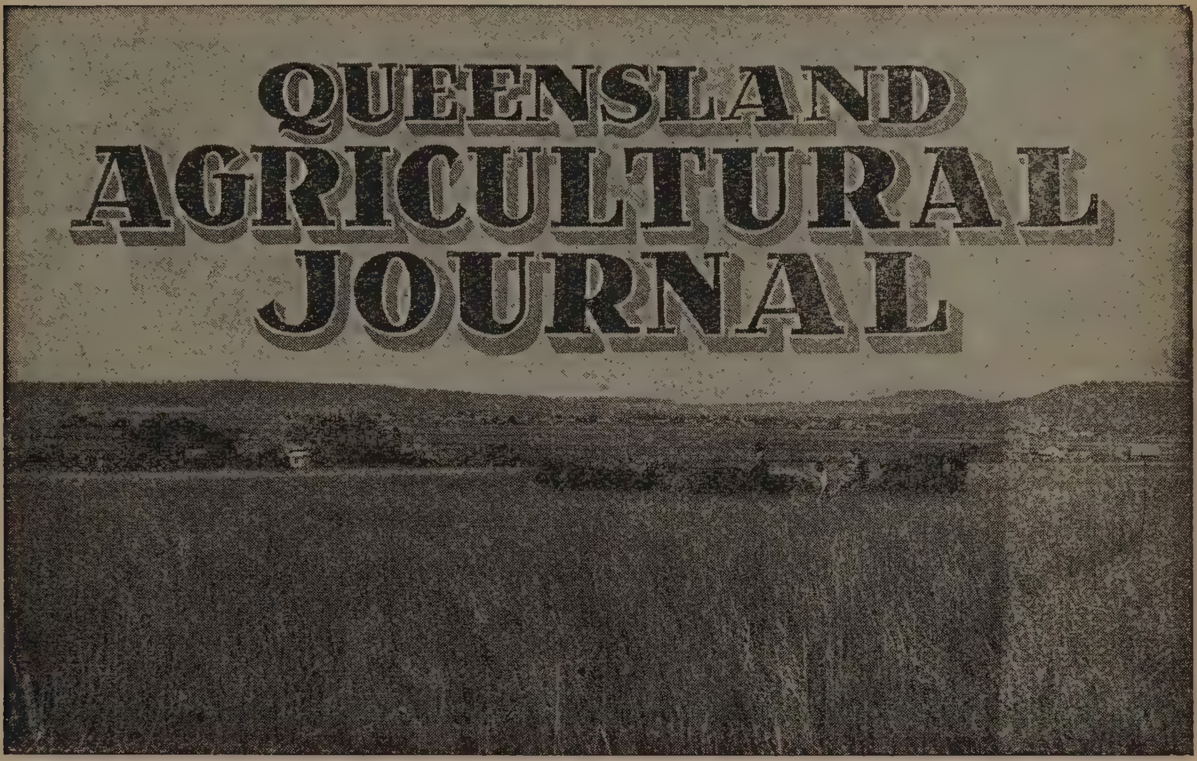

VOL. XLVII. 1 MARCH, 1937. PART 3

Event and Comment

The Problem of Unemployed Youth.

REPRESENTATIVES of all the States were present at a recent conference in Melbourne on the employment of youth, and which was convened by the Commonwealth Government. The problem was discussed from all angles. The general consensus of opinion affirmed the acceptance of the duty which we of this generation have in respect of the boys and girls now entering the period of adolescence. In Australia, as in most other countries, many young people are approaching full maturity without knowing what it is to have had a real job in life. In fact, many have already arrived at manhood and womanhood without finding a settled place in the industrial life of the community. The Premier (Hon. W. Forgan Smith, LL.D.) represented Queensland at the conference. Discussing the business done, he made it clear that while a pronouncement on the proceedings would be premature the problem would be attacked in a new way.

In the course of a statement on the subject, the Premier said that at the present stage it was interesting to review what Queensland had done to provide employment for boys and girls. The depression had brought with it so many problems that young people were left to fend for themselves, and consequently fared very badly. He added—

> "It was not until 1935 that Queensland made a determined and united effort to solve juvenile unemployment, and our real progress began from the day in January, 1935, when, as a result of a conference, a Juvenile Employment Board was set up and a Juvenile Employment Bureau opened.
>
> "The problem was looked at fairly and squarely, and it was decided that the best means of assisting children towards permanent employment was by directing them from school to work. The Department of Public Instruction was made the central point of activity, and the Juvenile Employment Bureau was set up to work in three sections:—
>
> 1.—Commercial Section: At the State Commercial High School and College.
>
> 2.—The Industrial Section: At the Apprenticeship Office.
>
> 3.—The Rural Section: At the Head Office of the Department of Public Instruction.
>
> "It was appreciated that there was little value in waiting for employers to approach the Bureau, so the policy from the beginning was to seek employers in order to find the right boy or the right girl for the right job. Employers were afforded the services of the Bureau which saved them much time and trouble in interviewing and classifying applicants, and the worry and bother of selection passed to the skilled officers of the Juvenile Employment Bureau.
>
> "There have been 6,072 boys and girls placed in employment through the Bureau during those two years of operation, and when the placements of the other Government activities are added, it is found that between 1st July, 1932, and 31st December, 1936, 16,856 boys and girls have been placed in jobs. That is a record of which Queensland has cause for pride.
>
> "First steps were taken in Brisbane. Each year 5,500 boys and girls complete their full-time education and seek employment, and of that number the Bureau, during its first year of operation, placed 53 per cent. of Brisbane's output. This excellent result was obtained by energy and enthusiasm. Nearly 2,000 children were found positions by the Commercial Section, over 3,000 by the Industrial Section, and nearly 1,000 by the Rural Section. Trained children from the Commercial Section find more or less ready employment in the offices, shops, and factories, but it is in respect of the rural employment that the most difficulty is encountered."

The Claims of Agriculture.

CONTINUING, Mr. Forgan Smith remarked that it was well known that in Queensland there was an aversion on the part of many parents from employment of their boys in the country. He said:—

> "Many parents prefer that their boy should remain out of work rather than that he should take a job on a farm; but such a view is a narrow one, when it is appreciated that the source of wealth is the land, and that the city is dependent on the country for its

prosperity. Agriculture is a science, not a form of drudgery. The farmer must be a man of knowledge and experience, who needs many qualities for success, and success in agriculture is as worthy as success in any other profession. But the public outlook has not been favourable.

"I pointed out in early announcements that 'it was definitely the Government's policy to encourage these boys to become future settlers with farms of their own.' In continuance of that policy we are training boys who will ultimately become successful farmers and good citizens of the State. Invaluable in that direction has been the assistance of the St. Lucia Farm School, the history of which is a particularly interesting one. Some five years ago the Minister for Agriculture outlined a project for the establishment of a farm training school at a place convenient to the city, and St. Lucia was the result.

"The idea behind the scheme was to give workless city boys an opportunity for training for a country career, to assist Australian youth to become good Australians. Since that date, 100 per cent. of the boys admitted to the school have been trained, employed on farms or proceeded to higher studies at the Agricultural College at Gatton, and 263 graduates of the school are now making their way in agriculture. But our attack upon youthful employment problem was not limited to that sector. Our apprenticeship scheme, which had long proved its worth, has been continued and increased, and since 1932 there have been 2,445 boys apprenticed in this State to skilled trades. Side by side with the work is the work of the Juvenile Employment Bureau. The Labour Bureau through its various offices in Queensland has been endeavouring to fill vacancies, and 1,708 boys and girls were placed through its agencies. The State Children's Department is another means of youthful employment, and 1,593 boys and girls have been placed by this Department.

"When the revival of employment of youth was instituted in 1935, the Government appreciated that it must give a lead to private enterprise, so Crown employment was stimulated, and as a result 1,305 young people have been placed in this way. One of the outstanding successes in Juvenile Employment has been the New Settlers' League, a body which works quietly and efficiently, placing boys in selected employment on farms, watching their progress, supervising their employment, and generally acting as father to 675 lads who have been found employment in this way since 1932.

"Prior to the Juvenile Employment Bureau operating, we had a Vocational Training Scheme which absorbed some 1,043 boys, and in addition through the Railway Department, the Forestry Department, the Police Department, the Rural Training Scheme, the Department of Labour and Industry, and the Riverview Training Farm Scheme, the total employment of boys and girls has been brought to 16,856, and now at this stage the Commonwealth proposes a scheme which is described as 'industrial repatriation' operating over two or three years, and provided the necessary grant is made available, the States will be enabled to multiply their efforts to achieve the aim which is to provide a job for every boy and girl in the community."

The Grasshopper Outbreak in Queensland.

1934-35.

Cat. N.L.

J. A. WEDDELL, Entomologist.

INTRODUCTION.

QUEENSLAND as a State does not suffer so severely from grasshopper plagues as some other areas throughout the world. Numerous species are, of course, present in the State, but only one or two are capable of plague incidence. The far western districts normally carry a moderate grasshopper population, of little economic significance, and only when large swarms tend to invade and breed heavily in the more valuable near western areas, or, alternatively, when the numbers in the far western districts rise to extraordinary proportions, would the problem of the plague grasshopper arise. It is mainly with the first of these alternatives as illustrated by the grasshopper outbreak of 1934-35 that the present report is concerned.

SECTION I.

HISTORY OF GRASSHOPPER OUTBREAKS IN QUEENSLAND.

Recorded Plagues Prior to 1934.

It is recorded in the Proceedings of the Royal Society of Queensland, Vol. 1, 1884, pp. 59-60, that Mr. H. Tryon referred to a locust plague infesting sugar plantations in March, 1884, on the Lower Herbert, North Queensland, the species being mentioned as probably *Stenobothrus vittifrons*. Damage to the extent of £30,000 was alleged. Some three years earlier, grasshoppers had spread over the plain, of 150 square miles, bounded by the Herbert and Stone rivers and the coast.

Another early reference in Queensland to grasshopper plagues is contained in "Report on Insect and Fungus Pests, No. 1," Tryon, 1889, pp. 217-223. The insect is referred to as *Oedipoda* sp., but the descriptions given establish the species as *Chortoicetes terminifera* Walk. Life history, habits and control are also discussed. It is recorded that Toowoomba was visited during December, 1886, by quite a plague of grasshoppers, which did immense damage to pasture.

Other records of past grasshopper invasions in Queensland usually refer to the yellow-winged locust, *Locusta danica*, L., by which is possibly meant *Gastrimargus musicus* Fabr. The following brief summaries of the records of significant outbreaks are taken from the annual reports of Mr. H. Tryon, then Government Entomologist and Vegetable Pathologist:—

1902-03.—Pasturage: Grasshoppers, Darling Downs.

1907-08.—Pasturage: Grasshoppers (*Locusta danica*), Rockhampton.

1911-12.—Yellow-winged grasshoppers (*Locusta danica*), Mossman River, Cairns, Tolga, Townsville, Springsure, Clermont, Kamerunga, Central and Western districts. Swarms of young hoppers occurred in Central and Western districts, September, 1911. In February, 1912, several properties were still suffering severely over hundreds of square miles. A mite (*Podolipus* sp.) preyed upon the adults, and a small hymenopterous insect, *Scelio* (*Australis* Frog.) attacked the eggs.

1914-15.—Grasshopper (*Locusta danica* L.). Considerable damage in the Ayr district to sugar cane. Grasshoppers (*Locusta danica*), throughout a vast area in the Central district of which Springsure might be regarded as the centre. The grasshopper parasite (*Podolipus* sp.—*Acarina*) was very numerous on adults in the Burdekin district in April, 1915.

1915-16.—Yellow-winged locust (*Locusta danica*), Townsville, Lower Burdekin, Herbert River—affecting grass, a brood hatching out during the middle of October; very destructive.

1916-17.—Grasshoppers, affecting pasturage, Toogoolawah district.

THE PLAGUE OF 1934-35.

The grasshopper outbreak in 1934 was unexpected, but surveys soon showed that pasture and crop destruction was bound to be extensive. In the more closely settled areas control operations were clearly necessary. This report summarises the observations made in Queensland and discusses the control programme that was put into operation.

Several officers took part in the investigations and control organisation. Associated with the writer in South Queensland at various times were Messrs. N. E. H. Caldwell, W. J. S. Sloan, and T. H. Strong; Mr. A. R. Brimblecombe investigated the outbreak at Wallumbilla; Mr. Sloan later reported an outbreak in the Callide Valley; Mr. J. H. Smith was responsible for the survey in North-western Queensland. The writer saw most of the phases of the outbreak in the southern portion of the State.

Species Concerned and Distribution.

The main species involved was the common plague grasshopper of Australia, *Chortoicetes terminifera* Walk., usually referred to in literature as "the wandering grasshopper," but better known in Southern Queensland as the "plague grasshopper." This species was widely distributed. Plate 73 illustrates the observed distribution of *C. terminifera* during 1934-35. Two species—*Gastrimargus musicus* and *Austacris proxima proxima* Walk.—were associated with *C. terminifera* in the North Queensland outbreak, but the lastmentioned species was even there the most important. A small species—*Phaulacridium gemini* Sjostedt (a brachypterous form)—attacked tobacco in the Texas distrct.

Species-locality records made during the currency of the attack are listed below:—

BRIEF SUMMARY OF SPECIES, DISTRIBUTION, AND IMPORTANCE OF GRASSHOPPERS IN QUEENSLAND, 1934-1935.

1. *Chortoicetes terminifera* Walk.—wandering or plague grasshopper.

Toowoomba	Occasional specimens collected.
Warwick, Oakey, Jondaryan, Wallumbilla, Tara, Roma, Mitchell, Taroom, Callide Valley	Infestations of relatively minor importance.
St. Helens, Irongate, Yarranlea, Millmerran, Kooroongarra, Leyburn, Inglewood, Yelarbon, Texas, Goondiwindi and surrounding districts.	The main area in which infestation was important, both locally and as a potential menace to other districts. Successive generations bred in the localities mentioned.
Far Western districts, including Cunnamulla, Eulo, Charleville, Quilpie, Tambo, Blackall; Northern districts, including Julia Creek, Richmond, Sellheim	Pastoral districts over which mainly adult swarms of various size and density were observed.

2. *Gastrimargus musicus* Fabr., known as the "yellow-winged locust"—

Dalveen, Texas, Goondiwindi, Tambo	Occasional specimens collected.
Richmond, Hughenden, and otherwise widely distributed in North-west Queensland	Important as pasture pest in the North.

3. *Austacris proxima proxima* Walk.—

Tara, Goodiwindi, Tambo	Occasional specimens collected.
Julia Creek, Cloncurry, N.Q.	Fairly important as a pasture pest in the North.

4. *Phaulacridium gemini* Sjostedt—

Glenarbon, Texas, Riverton	Important as a pest on young tobacco.

Of the following species, only occasional specimens were collected at the centres mentioned against each:—

5. *Caledia propinqua* Walk.	Dalveen, Texas, Goondiwindi.
6. *Oedaleus australis* Sauss.	Toowoomba, Texas, Cunnamulla.
7. *Aiolopus tamulus* Fabr.	Westbrook, Texas, Goondiwindi, Richmond.
8. *Acrida turrita* Linn.	Dalveen.
9. *Pycnostictus seriatus* Sauss.	Dalveen.
10. *Monistria* sp.	Dalveen.

Position in South-eastern Queensland.

Several small-scale invasions had occurred some time prior to the main outbreak in Southern Queensland, but their significance was not realised until the main attack appeared. For instance, during the preceding three or four years, flying grasshoppers from New South Wales had crossed the McIntyre River, which constitutes the State border at Goondiwindi, and invaded holdings in Queensland. Neither the degree of the invasion nor the area occupied seem to have been very great, except in the case of swarms that were reported as having been dense in April-May, 1934.

In parts of the Kooroongarra-Millmerran-Pittsworth area flying swarms of grasshoppers were said to have been common from the end of March until the beginning of May, 1934. The swarms were very dense and caused considerable damage to pastures, young cereals, and other fodder crops. Extensive egg-laying was observed by the farmers, but as the swarms diminished and a period elapsed during which hoppers did not emerge, it was locally thought that the trouble was at an end. Egg-laying, however, had been very considerable, and the non-emergence of hoppers was simply due to the cold weather.

Early in September, 1934, young hoppers were noticed, and by the middle of the month the size and density of the swarms were alarming. About the same time hoppers emerged in the Goondiwindi-Yelarbon districts. Control measures were not then thoroughly organised, and countless survivors completed their development by the end of October. Dense swarms of adults commenced to traverse the country about 1st November, the general migration in the Goondiwindi area being to the east and north-east. At the same time further swarms crossed the McIntyre River into Queensland.

Oviposition was first noted on 3rd November, when a large egg-bed, an acre or more in extent, was located at Goondiwindi. Hopper emergence commenced on 22nd November—an incubation period of nineteen days. The egg-period for this brood varied from nineteen to twenty-one days.

The Inglewood district suffered two mass invasions of flying adults, these occurring on 2nd and 3rd November and again from 13th to 25th November. A somewhat dispersed population persisted for approximately the whole month of November. Oviposition occurred at numerous places, and control work aiming at hopper destruction was somewhat complicated by the inevitable overlapping of generations that followed.

The first adults from this generation were flying in the Goondiwindi district on 4th January, 1935.

Various parasites and birds did excellent work, particularly during the second generation, and these, together with the control operations, considerably reduced the pest population. Weather conditions were also unfavourable for the pest. The rainfall towards the end of the year was above average in the districts concerned, and culminated in exceptional falls giving flood conditions. Large numbers of grasshoppers were found dead in creeks and low-lying ground. This phenomenon was not personally investigated, and it is uncertain whether grasshopper

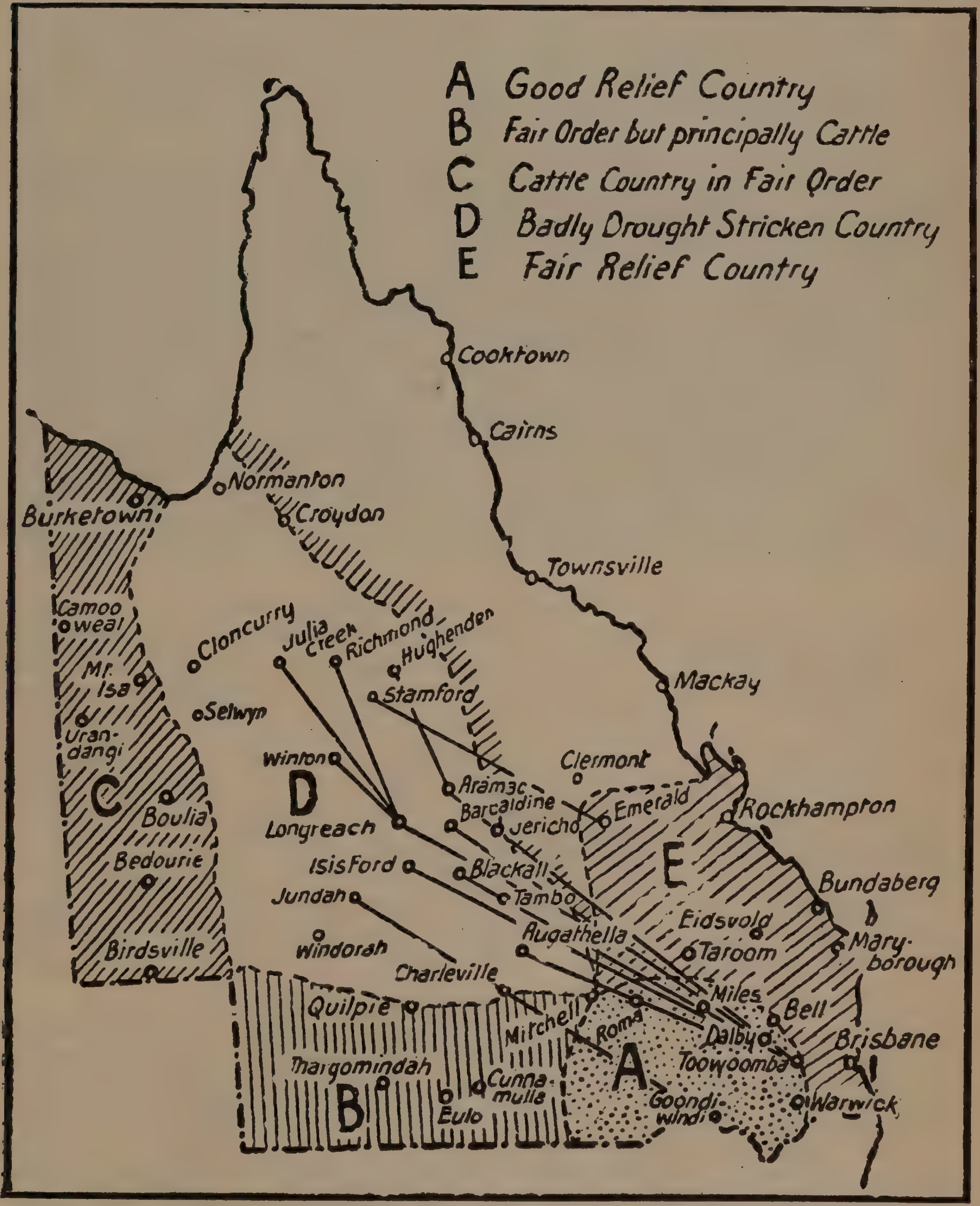
A Good Relief Country
B Fair Order but principally Cattle
C Cattle Country in Fair Order
D Badly Drought Stricken Country
E Fair Relief Country
Cooktown
Cairns
Normanton
Croydon
Burketown
Townsville
Camooweal
Cloncurry
Julia Creek
Richmond
Hughenden
Mt. Isa
Selwyn
Stamford
Mackay
Urandangi
Winton
Clermont
Aramac
Barcaldine
Jericho
Emerald
Rockhampton
C
D
Boulia
Longreach
Bedourie
Isis Ford
Blackall
Tambo
E
Bundaberg
Jundah
Eidsvold
Augathella
Taroom
Maryborough
Windorah
Charleville
Birdsville
Miles
Quilpie
Mitchell
Roma
Bell
Dalby
Brisbane
Thargomindah
Toowoomba
A
Cunnamulla
B
Eulo
Goondiwindi
Warwick

Plate 74.

From the "Courier-Mail," Brisbane, 23rd February, 1935, showing the condition of the country at the time.

destruction was due to drowning or pathogenic organisms aided by the moist conditions. The probability is that both factors were operative.

The last record of breeding at that time was from the Yarranlea district, where hoppers emerged in the second week of January, 1935. These were almost certainly delayed second-generation insects, as in that district insufficient time had elapsed for the development of another brood.

A slight recrudescence of grasshopper trouble occurred in portion of the Goondiwindi-Texas country in November, 1935, when a report from the resident stock inspector indicated that small numbers of hoppers were hatching. The outbreak was on quite a small scale, and the situation did not develop further.

In the 1934-35 outbreak, concerted measures were necessary for the control of *C. terminifera* only. At first baiting was confined to the Pittsworth-Kooroongarra and the Goondiwindi districts, the latter being more correctly referred to as the Waggamba Shire. However, with the second generation, the infested areas had markedly increased, giving practical coalescence (Plate 73). Agricultural activities in the north-easterly portion of this area, particularly in the direction of Millmerran and Pittsworth, are varied, and include wheatgrowing and dairying. The main wheatgrowing areas on the Darling Downs are comparatively close. The grasshoppers were therefore not only a serious pest in the areas first invaded, but a potential menace to valuable adjacent country. The Goondiwindi district is pastoral country, carrying sheep mainly, and here again the pastures were attacked. Some graziers claimed that the carrying capacity of their holdings was temporarily reduced by amounts varying up to 25 per cent., and there was no reason to doubt this estimate.

On pastures that were eaten bare by the grasshoppers, early regrowth followed only if growing conditions were good. For instance, certain areas that were eaten out during the previous April-May, 1934, remained bare for several months, including the winter period. Fortunately, regrowth in pastures eaten during November and December was very rapid, the weather being warm and exceptionally moist. The contemporary rainfall at the time was therefore doubly beneficial both in rounding off the control operations and in stimulating pasture recovery.

The value of the Goondiwindi district and surrounding areas was well demonstrated early in 1935. The summer of 1934-35 was a serious drought period for large areas of Central and North Queensland. A useful map (Plate 74), reproduced here by courtesy of The Queensland Newspapers Pty. Ltd., was included in an article published in the "Courier-Mail" on 23rd February, 1935, describing the pastoral position at the time. It will be observed that the south-eastern area in question was rated as good relief country capable of carrying considerable numbers of stock on agistment.

Crops were variously attacked by the insects. Swarms which destroyed a variety of other plants left tobacco untouched. Potatoes were stripped bare, but under suitable growing conditions satisfactory recovery took place and a crop was produced (Plates 75 and 76). Several patches of lucerne were destroyed by flying swarms, a typical example being shown in Plate 77; in this case flying swarms frequenting the crop for two days stripped 10 acres ready for cutting. Similarly, oats were stripped (Plate 78), while other fodder crops such as Sudan grass were eaten to the ground. Young wheat was completely destroyed by hopper swarms, being eaten out on a face. The flag of half-grown wheat was taken by both hoppers and adults, but usually these plants made a recovery. Adults attacking mature wheat fed on the ear, often also cutting the stalk (Plate 79).

Secondary losses occurred in one or two instances. In a misguided attempt to use crops that were threatened by hoppers, certain farmers ran dairy cattle on young Sudan grass, which is not normally grazed. A number of deaths unfortunately followed, due to prussic acid poisoning, and indirectly added to the toll levied by the grasshoppers.

Practically all vegetable crops were stripped bare, or, if young or succulent, the plants were eaten to the ground. This damage was important in western districts generally and on large holdings which need to be self-supporting as regards fresh green vegetables.

Plate 75.
Potato crop stripped by flying swarms.
[*Photo. N. A. R. Pollock.*

The significant features in the south-easterly phase of the outbreak may be stressed as follows:—

1. The insects were present in large numbers, causing very definite losses.
2. The country infested was valuable, and closely settled areas slightly further east were menaced by the possibility of grasshopper movements in that direction.
3. The size of the holdings was not, as a rule, too large to prevent the successful adoption of effective control measures.

Position in South-western Queensland.

West of the Goondiwindi area small-scale infestations were located in the vicinity of Talwood, and south of Dirranbandi, in November, 1934. These represented migrations from the south. Some breeding took place, but there was no tendency towards district-wide infestation. Occasional reports also were received from points further west, notably Eulo (October), Charleville (November), and Tambo (December). In order to obtain some idea of the status of these infestations in relation to the south-eastern phase, a rapid survey of the southern and western

Plate 76.
Showing regrowth of the potato crop illustrated in Plate 75 after four weeks.
[*Photo. N. A. R. Pollock.*

areas was made early in January, 1935. The route followed is indicated on the map.

The map shows diagrammatically the significant features of the grasshopper position as determined both by observation and by enquiry. No sign of grasshopper activity between the infested south-eastern areas and a point about 30 miles east of Cunnamulla was observed. Here a dispersed swarm of adult grasshoppers was located. Much of the intervening country had been open forest on poor sandy soils growing coarse grasses. Isolated areas of Mitchell grass flats were not uncommon. It

Plate 77.
Remains of lucerne crop destroyed by flying swarms infesting patch for two days.

was on such an area, carrying at the time poor herbage—mainly stunted saltbush—that the grasshoppers were found. In travelling westward, timbered red-soil country free from hoppers and the open areas with light grasshopper populations alternated until the country opened out into the Mitchell grass plains, commencing some few miles east of Cunnamulla. On a pastoral station 10 miles east of Cunnamulla adult grasshoppers were fairly dispersed over wide areas, but with a heavy concentration along the bore drains. Conditions were very dry, and there was little grass away from the edge of the bore drains, the main herbage being only stunted saltbush 6 inches high. The grasshoppers were feeding, but the concentration was not sufficient to cause serious damage.

Plate 78.
Oats stripped by flying swarms.
[*Photo. N. A. R. Pollock.*

Late in December a heavy swarm—the largest that had been seen in the district for some years—was reported to have passed over, travelling north. A similar swarm had apparently swept over the southern border during December from New South Wales and moved north in the direction of Cunnamulla. There seems little doubt that these records refer to the same migrants.

From Cunnamulla to Tambo scattered swarms of various dimensions were encountered, flying always with a generally northerly trend. Adult grasshoppers were said to be common further west, but there were few indications of the pest occurring in numbers very far east of the line joining Cunnamulla and Charleville. Swarms were reported from at least as far west as Quilpie and Adavale. North of Charleville, on the Ward River road, several reports of grasshoppers were received to as far as Tambo. In most cases a northerly flight of the adults had been noticed. So far as the observations went, the grasshopper density increased northwards, and this may possibly have been due to the overtaking of migrating swarms that had been reported to be passing northwards. Near and into Lansdowne Station, south of Tambo, a huge swarm of flying adults, the swarm extending 20 miles north and south, was encountered, the flight direction being almost due north.

Beyond the limits of the migrant swarm just mentioned the infestation on this property was widespread. There was marked concentration of the insects along the bore drains and in slight hollows. The grasshoppers had arrived in two main swarms, the first being about the third week of December, and the second during the first week of January.

Much of the country was drought-stricken, and a few points may be worthy of mention. There was practically no green feed for the grasshoppers, except the tiny shoots of herbage on the drain margins. This paucity of feed may account for the fairly rapid migration of the insects. Many observers felt that even large swarms wandering haphazardly over such parched country would make little difference to the graziers' losses.

Plate 79.

Wheat showing loss of ear; adult grasshoppers invaded and damaged the portion to the right.

Conversely, in good seasons the stock carried on western lands could consume only part of the available fodder, and it would appear that even a considerable grasshopper population would not appreciably reduce the carrying capacity of the properties. The insects are more or less common every year in these parts of the State, the noteworthy feature during the period under discussion being the much larger and denser swarms that were present. Even so, there were large areas between swarms on which it would have been difficult to collect grasshopper specimens.

Swarms were reported as having passed through the Tambo township early in January, moving in an easterly direction. Other reports were received of flying swarms up to 100 miles west of Tambo.

Apparently little or no breeding had taken place in the Cunnamulla-Tambo country, for only the flying insects were seen by the writer, and few residents were aware of the breeding habits. Only one station-owner had noticed egg-laying and hopper swarms, on a small area, and a few had seen the mating and clustering of adults which normally precede egg-laying. Large or widespread breeding grounds such as could give rise to the extensive swarms were quite unknown. Certain areas on which clustering had been observed were thoroughly examined, but although the general soil conditions of these areas seemed suitable for oviposition, no evidence that it had occurred could be discovered.

Grasshoppers occurred sporadically along the stock route from Tambo to Augathella and in the neighbouring properties in the plains country until the timbered country was entered, about 20 miles north of Augathella. With the change in vegetation there was a complete cessation of grasshopper occurrence. A few hoppers were seen on isolated timber-free areas between Augathella and Morven, but no worthwhile pasture destruction had been recorded.

The Morven district was badly in need of rain, but towards Mitchell and further east there was feed in abundance. Swarms of half-grown hoppers were encountered on the road a few miles east of Mitchell, and on some properties grasshoppers had been present since late November. On one property baiting work on a big scale had been necessary and had given good results. The infestations were, however, quite patchy, fortunately not being of the general nature seen in the Goondiwindi and allied areas.

Roma district showed even better growth than Mitchell, and the grasshopper position was of much less importance. Only a few properties appeared to have been affected, and these to only a small degree. At Surat nothing was known locally of any grasshopper trouble. This district was more or less isolated from infested areas by timber barriers, and these, together with the fairly general timber cover still existing, ensured some protection against invasions from elsewhere.

At Glenmorgan, about 60 miles east from Surat, grasshopper infestation on a property south on the Moonie River was reported. This appeared to represent the northernmost extension, in that locality, of the Goondiwindi infestation. As has elsewhere been indicated, there were minor outbreaks at Wallumbilla, Tara, and Jondaryan, where two small generations occurred in the spring and summer months.

The main impressions gained from the survey were as follows:—

1. The really serious economic infestation had been correctly recognised early in the campaign as covering the Pittsworth, Millmerran, Inglewood, and Goondiwindi areas.

2. The main western infestation occurred on the open plains country, and its eastern margin was delineated by the western margin of the main timber belt which follows a line drawn somewhat east of Cunnamulla and Charleville. The area involved was at least 100 miles wide east and west, no information being obtained from points further west, and extending from the southern boundary of the State northwards. A dispersed grasshopper population is usual to this territory, but during the period from November, 1934, to January, 1935, there was a marked increase much above the usual in the numbers of the pest.

3. The country in between the infested south-eastern and south-western areas was comparatively free from grasshoppers, except for a few sporadic outbreaks.

4. The control of grasshopper infestations of a general nature in the western country, consisting as it does of large pastoral holdings, was quite impracticable, except in isolated cases. In this connection, therefore, it was important that there were few records of actual breeding. It would be difficult in that country to assess the losses—if any—caused by the pest.

Position in North and North-western Queensland.

During January, 1935, Mr. J. H. Smith visited several western districts, including Julia Creek, Hughenden, and Charters Towers, and investigated reports of grasshopper activity.

Three species of grasshoppers were implicated in the outbreaks, these being *Gastrimargus musicus, Austacris proxima proxima,* and *Chortoicetes terminifera.* The three species will be separately discussed.

In the past the more spectacular flights of grasshoppers in the North-west appeared to be due to the species *G. musicus.* The only authenticated record of breeding immediately prior to the visit was near Richmond, hoppers showing a considerable colour variation being seen in October and November, 1934. The adults migrated from these breeding grounds early in December towards the cattle stations of the Gulf and the Cape York Peninsula. The species is widely distributed in North Queensland. There can be little doubt that the occasional outbreaks in cane on the coast can be ascribed to this species; it has not, however, been implicated in the injury reported in other crops—*e.g.,* tobacco, tomato, and sundry vegetables.

The comparatively large species, *Austacris proxima proxima,* was present on most western properties. In the more drought-stricken districts, adults swarmed round the homestead greenery, and vegetable gardens were almost wiped out; the foliage was stripped from fruit and shade trees, while the bark was frequently gnawed from the twigs and lesser limbs. Only the oleander came through unscathed, while the saltbush in common use as hedge was less attractive than most other plants. Graziers contended that this insect was most active in the more heavily timbered country, particularly in the vicinity of the Flinders and Saxby Rivers. Certainly adults were much more common in January in the cattle country thereabouts than elsewhere, but fair rains had fallen previously; and the recent growth may have drawn them from the less favourable country lying to the south.

The plague species, *C. terminifera,* was apparently quite familiar to the graziers. It was very common wherever green feed was to be found in the sheep country adjacent to the north-west railway line. Towards the north it yielded place to the larger species already discussed, but for the most part both forms existed side by side. Hughenden seemed to have been invaded much later than centres further west. As already mentioned, the slight hopper outbreaks in October and November, 1934, were mainly due to the larger species, and an invasion from the south was generally postulated to explain the presence of *C. terminifera.* Only one relevant piece of information came to hand to support this. A large swarm passed over a property at Ruthven, in the Isisford district, south of Hughenden, on 22nd December, 1934, then travelling north and making no attempt to settle locally. The insects present in Hughenden in January showed a more or less dilatory flight a few feet from the ground during the morning hours in an easterly direction.

So far as the three species were concerned, the position at the time of the survey was as follows:—*G. musicus* was quite absent from the country under review; *A. proxima proxima* was dominant in the vicinity of the Flinders River, but occurred sporadically elsewhere; *C. terminifera* was the most important species in the sheep country as far west as Julia Creek and east to Sellheim. Nearer the coast, occasional individuals were to be found, but the grasshopper fauna was of the mixed type usually associated with the wetter areas.

Dissections of a large number of adult females of *C. terminifera* and *A. proxima proxima* were made. The ovaries in *C. terminifera* were quite undeveloped and occupied a small part of the body cavity. On the other hand, the ovaries of *A. proxima proxima* contained well-defined and fully formed eggs. In many insects the distended ovaries occupied the greater part of the abdomen and extended well into the thorax, giving the impression that egg-laying was imminent.

In considering the significance of grasshopper outbreaks in the North, Mr. J. H. Smith discussed the matter as follows:—

Though the damage to station gardens and fruit and shade trees was considerable, adverse troubles of this kind have little effect on the commercial wellbeing of the graziers. Enquiries into the effect of grasshoppers on the feed distributed over the run elicited a variety of opinions, but generally the insects are not regarded as serious pests. Hopper swarms have occasionally overrun a property and destroyed much of the grass, but appreciable losses through the adults have not so far been recorded. In any case such losses would be difficult to estimate, for their importance depends on the growing conditions at the time and the numbers of stock carried on the property.

March outbreaks of either hoppers or adults would invariably be a less serious matter than spring plagues of the insect. At that time of the year the ground is, as a rule, well soaked with rain, and, as growing conditions are good, the ravages of the pest are made good in a very short time. Spring outbreaks are, however, a more important matter. Fodder reserves are frequently reduced to a minimum at that time, and any abnormal depletion may compel the grazier to send his stock to agistment pending the recovery of his run when the summer rains fall —usually in February.

The relative importance of hoppers and adults in pasture losses is difficult to determine. Hopper injury has in the past been more spectacular. The dispersed adult phase was, however, common to the whole district, and must have caused appreciable injury in 1934, when feed was comparatively scarce. In January, 1935, the adult phase alone was of any consequence.

Possible Climatic Association.

Attempts to explain the original appearance of the grasshopper plague in the Millmerran Shire can only be conjectural. The insect normally frequents the drier areas of the State; yet for several months prior to the invasion rainfalls were generally above the average in the more important grasshopper-infested districts. Table 1 gives the monthly rainfall records in Millmerran for the period June, 1933, to May, 1934, together with the respective monthly means. Months in which more than average rain fell are indicated by an asterisk:—

TABLE 1.

Rainfall.	1933.							1934.				
	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.
Actual	200	228	129	270	236	514	360	320	507	5	149	39
Mean	189	158	115	136	192	263	301	321	290	253	146	147
	*	*	*	*	*	*	*		*		*	

TABLE 2.—SHOWING THE MONTHLY RAINFALL RECORDS FOR 1934 AND THE MONTHLY MEANS (IN ITALICS BENEATH) IN THE SOUTHERN DISTRICTS OF QUEENSLAND HAVING SOME ASSOCIATION WITH THE GRASSHOPPER INCIDENCE OF 1934.

* Indicates month in which rainfall was above average.
H Indicates presence of hopper swarms.

A Indicates presence of adults in swarms.
E Indicates presence of eggs.

District.	Rainfall.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Districts little or not infested.													
Toowoomba	Actual	542	1,088	23	628	134	111	381	140	87	312	365	738
	Mean..	*508*	*460*	*367*	*266*	*216*	*242*	*210*	*165*	*213*	*256*	*338*	*446*
		*	*		*			*			*	*	*
											A. & H.	small	numbers
Allora	Actual	376	353	4	316	25	94	332	107	104	298	303	786
	Mean..	*395*	*290*	*236*	*180*	*158*	*176*	*171*	*126*	*180*	*217*	*266*	*324*
			*		*			*			*	*	*
		No infestation.											
Districts Infested in which Heavy Breeding Occurred.													
Pittsworth	Actual	308	364	0	505	120	83	276	67	78	228	344	876
	Mean..	*379*	*308*	*297*	*174*	*141*	*180*	*180*	*119*	*165*	*217*	*287*	*364*
			*		*			*			*	*	*
				A	A	A	E	E	E.	H	H	A E H	A E H
Millmerran	Actual	320	507	5	749	39	70	229	151	68	349	480	901
	Mean..	*321*	*290*	*253*	*146*	*147*	*189*	*158*	*115*	*136*	*192*	*263*	*301*
			*		*			*	*		*	*	*
				A	A	A	E	E	E	H	H	A E H	A E H
Goondiwindi	Actual	134	422	5	53	101	115	199	164	78	377	247	446
	Mean..	*290*	*257*	*249*	*154*	*173*	*185*	*176*	*125*	*151*	*180*	*228*	*299*
			*					*	*		*	*	*
				A	A	A	E	E	E	H	H	A E H	A E H
Inglewood	Actual	266	433	33	246	7	68	274	180	145	356	174	880
	Mean..	*321*	*278*	*257*	*134*	*173*	*190*	*182*	*130*	*166*	*216*	*267*	*310*
			*		*			*	*		*		*
												A E H	A E H
Texas	Actual	266	284	60	158	35	142	263	237	100	506	273	769
	Mean..	*331*	*258*	*223*	*155*	*156*	*192*	*186*	*141*	*161*	*216*	*234*	*320*
								*	*		*	*A E H	*A E H
Districts Typical of the South-west carrying Swarms of Adults towards the end of the Year.													
Cunnamulla	Actual	18	155	0	129	15	132	116	83	25	268	219	16
	Mean..	*126*	*210*	*138*	*113*	*115*	*120*	*90*	*67*	*86*	*91*	*106*	*160*
					*		*	*	*		*	*	
				No special records									A
Tambo	Actual	102	276	38	222	11	91	197	0	12	93	50	23
	Mean..	*286*	*303*	*258*	*146*	*143*	*127*	*116*	*76*	*89*	*139*	*189*	*261*
					*			*					
				No special records.									A

It will be seen that in the month of March, 1934, only 5 points of rain fell in the Millmerran district. The migratory adults arrived about this time and found an excellent body of feed, which enabled them to flourish and lay a full complement of eggs. The serious infestation in the district may then possibly be explained by the following sequence of events:—

1. A building-up of grasshopper population in some contiguous locality (the nearest record was from the New South Wales border at Goondiwindi);
2. Suitably dry weather conditions coinciding with the appearance of a swarm of winged adults;
3. The earlier rain ensuring a fine body of feed locally.

This correlation is purely tentative both from the point of view of the origin of the first swarms and with regard to the rainfall association. Information within the district was quite conflicting as to the direction from which the swarms first appeared. This was probably due to the extensive circling flights that took place within the district. The insects thus appeared to the several farmer observers to come from different compass points. It is possible that these swarms flew in from Goondiwindi in an indirect line, proceeding first north and then east. The invasion did not arrive by way of Inglewood, for the whole of this area was continuously free until the 1934 spring brood became adult and invaded the area travelling north-easterly from the direction of Yelarbon. Had the earlier swarms passed over Inglewood district, the insects would have found conditions there similar to those in Millmerran, and, of course, their passage would have been noted. Residents at Kooroongarra were emphatic in their statement that, prior to the autumn of 1934, grasshoppers had been practically unknown in the locality, and that the adult swarms that were prevalent in that autumn had not developed in the district.

The further spread of the insects that occurred in November, 1934, is not explicable by the low rainfall theory, as all of the recording stations within the district as a whole showed rainfall totals higher than the average for the months of October and November. The ultimate disappearance of the grasshoppers as a plague was in part linked with heavy rainfall, for by the Christmas period flooding effects were common.

The accompanying rainfall table (Table 2) may be of some interest in relation to the incidence of *Chortoicetes terminifera*. In this table will be seen the high rainfall totals in the main grasshopper-infested districts for the months of October, November, and December.

[TO BE CONTINUED.]

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The PIG FARM

Carcass Quality of Bacon Pigs.

E. R. HOLLAMBY, Inspector of Slaughter-houses.

THE type of pig suitable for bacon curing is frequently a subject of inquiry. Local market requirements are a dressed carcass weighing from 95 to 120 lb., producing finished sides from 38 to 42 lb. Bacon pigs should be so slimmed, as it were, that the back fat at the shoulder shall not exceed 1¾ inches, tapering to ¾ inch at the loin.

The British market requires a slightly heavier carcass, weighing from 130 to 160 lb., with dressed sides ranging from 56 to 65 lb., and so slimmed that the fat at the shoulder shall not exceed 1¾ inches, tapering to ¾ inch at the loin.

Some pigs cannot slim. Briefly, the type of pig that can slim must be long and have fairly well sprung ribs, with fine bone and skin and hair of fine texture. These essentials put nondescripts and mongrel-bred pigs right out of consideration and place a limitation of choice on breeds or crosses that supply the requirements of the trade.

Some breeds are so short and predisposed to fat that they simply cannot comply with the essential conditions. Given suitable housing and conditions, feeding has a most important influence in developing the characteristics required—the development of the thickness of lean meat without getting too much fat, which is the main problem in pig production to-day.

It is the protein in the food that produces lean flesh. The fats, carbohydrates and digestible fibre provide heat and energy and form fat, but cannot make lean meat. The baconer must produce plenty of lean flesh with only a moderate amount of fat if it is to grade well on slaughter. Although it is not possible to convert a fat matured pig into a clean fleshed animal simply by feeding it on protein-rich food, it is, nevertheless, true that a potentially lean fleshed pig can be converted quite easily into an overfat carcass by improper feeding.

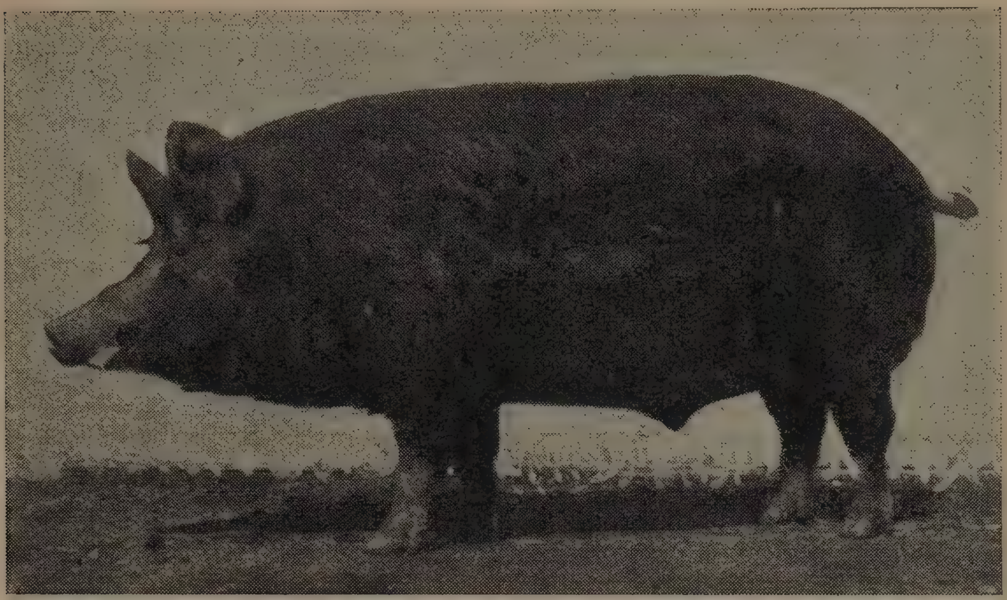

Plate 80.

Champion Prize-winning Tamworth boar, Zillvale Skipper, owned and exhibited by Wide Bay Stud Piggery, Gympie, Q. Zillvale Skipper is probably the most successful Tamworth boar exhibited at Brisbane R.N.A. and other Shows for many years, for, in addition to winning championships at Brisbane, he has been most successful at other Shows. He is a reliable stock-getter, and his progeny are in great demand.

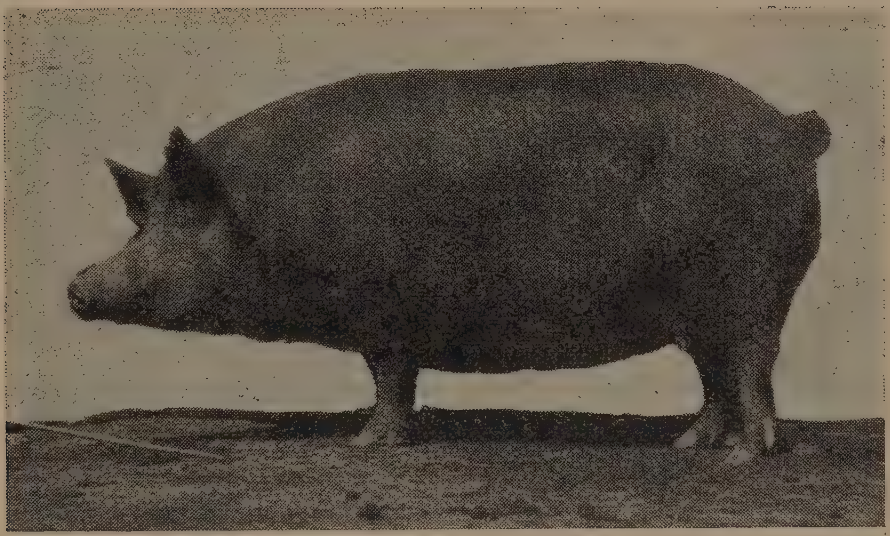

Plate 81.

Champion Prize-winning Tamworth sow at Brisbane Exhibition, 1936. This sow, shown by Wide Bay Stud Piggery, Gympie, is Wattledale Trilby, assuredly one of the best of her breed in the State. Note deep, lengthly body, well-developed hams, and neat, attractive carriage of this well-known animal, winner also of many prizes at country Shows.

The various points which go to make up good carcass quality are mainly a matter of body proportions and composition, which do not remain constant but change as the pig grows. In the pork type, they change quickly so that they are right, i.e., small proportion of head and bone and high proportion of loin and lean meat with just the right amount of fat—½ inch over the loin—at 70 to 80 lb. dressed weight. In the bacon type, these proportions are not attained until the pig reaches bacon weight. The proportions required by the consumer are the same for both pork and bacon pigs, but the weights at which these two types arrive at these proportions differ, the one being early maturing and the other late maturing. The difference between pork and bacon pigs is mentioned so that farmers may realise the difference between the two types.

Plate 82.

Large White boar, Highfields Faithful 10th, winner of Reserve Championship at Brisbane Exhibition and of prizes at other Shows in the State. This boar, shown by Mr. J. A. Heading, of the well-known Highfields Stud at Murgon, is of a long, compact type, neat and attractive, light in the forequarters, and showing plenty of character. The Large White of to-day is a much superior animal to that of former days.

The various points required in the dressed carcass, if it is to grade well, are:—

The back fat forms a good measure of the fatness of the carcass generally, and to-day the public do not require very fat bacon. The fat is always much thicker at the shoulders than at the loin in a young pig, and the difference in ratio between these two parts narrows gradually as the pig grows. Thus a back fat tapering gradually from shoulder to loin is an indication that a carcass has not yet attained its full maturity and fatness; such carcasses are required for bacon production. The pork types—being small, short, blocky, and early maturing—carry more fat at bacon weight than do the larger, longer and later maturing bacon types. By lengthening the pig, the chances of getting too thick a back fat are reduced. On the same feed, sows usually grade better than barrows in respect of back fat measurements. A soft, oily fat is objectionable to the consumer and curer; as firm a fat as can be produced is required. This is influenced more by feeding than by the breed, except that slow growing pigs tend to have a softer fat than fast growing ones.

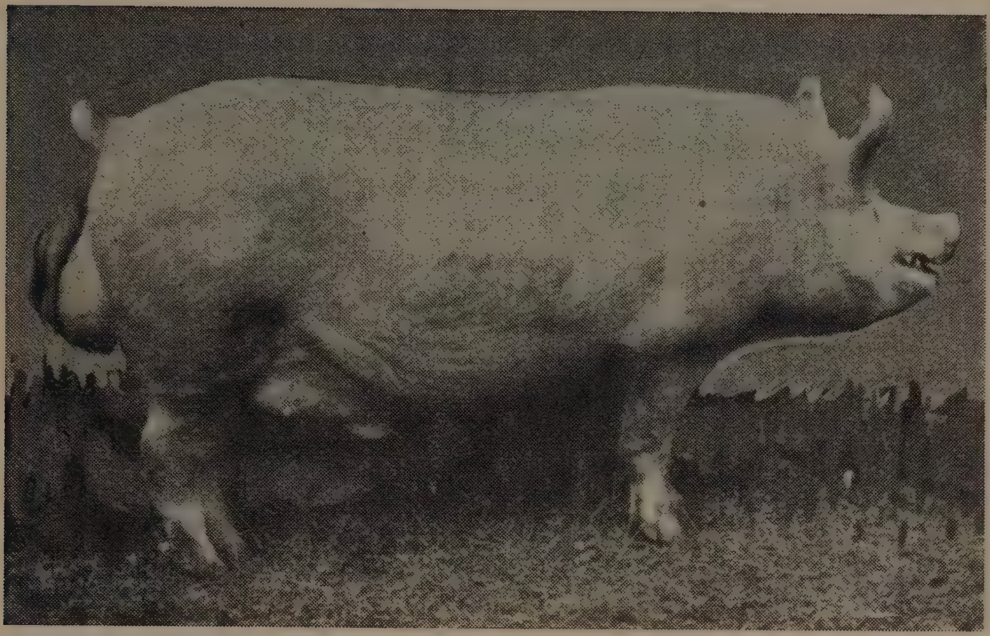

Plate 83.

Champion Large White boar at the Brisbane Exhibition, 1936, and winner of many other champion prizes. Mr. J. A. Heading has in Gatton David a Large White he can be justly proud of, because this boar has a type and conformation sought by pig raisers in every breed. His length, depth, light forequarters, and an even temperament are features that stamp him as an excellent sire of quality stock.

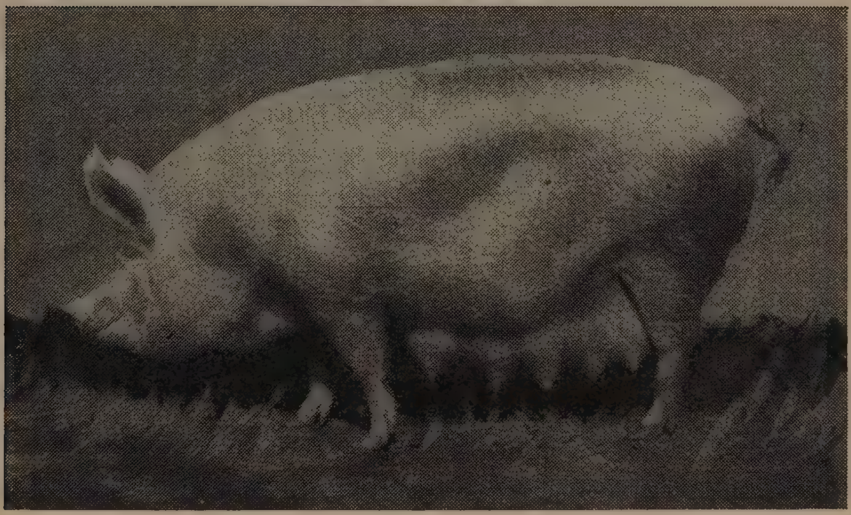

Plate 84.

The imported Large White sow Grinton Sunbeam, winner of Female Championship in Large White Section, Royal National Exhibition, Brisbane, 1936. After winning her championship she returned home to produce a litter of nineteen pigs. Her progeny are in constant demand, and she has proved a most profitable animal, upholding the world-wide reputation of the pig as a rent-payer and a mortgage-lifter.

Plate 85.

Championship Berkshire boar at Brisbane Exhibition, 1936, shown by Queensland Agricultural High School and College, Lawes, Q. This boar, Grafton Jock, is of the latest English type, and has a long, deep, masculine body, well-developed hindquarters, and is nicely marked, as is required in this breed. He has also been successful at many country shows.

Plate 86.

The Champion Berkshire sow at Brisbane Exhibition, 1936, J. Barkle and Sons' Cawdor Pride, a sow of excellent conformation, capable of producing and suckling large, thrifty litters. Note her well-developed udder and teats and her compact frame. She is an even-tempered animal of up-to-date type, and has won for her owner many premier awards, including sow and litter class at Brisbane in 1935.

The consumer requires a thick streak of lean meat, and this should be obtained by developing the thickness of the muscle or lean meat without getting too much fat. On the young pig, bone reaches its maximum growth first, then muscle, while fat makes its maximum growth later. This knowledge provides a sound reason for weighing pigs at regular intervals after weaning, for it is just after this time that the lean meat begins to develop; and pigs which grow well then will grade better than those whose growth is checked at this stage.

At birth the ham is nearly all bone and poorly fleshed, while as the pig grows the bone becomes proportionately smaller and the meat is " let down " to the hocks. A good ham is one in which these age changes are well developed. The ham should be fleshy, well rounded, deep and broad. Width of the buttock just below the tail is a character that could be improved in many pigs.

Apart from the fact that a pig which is long for its weight will tend to have less fat than one which is short for its weight, length is required in order to give a larger portion of back cuts as compared with belly cuts, for the former are higher priced than the latter. A thick streak is required, but not a long one (so as to form a good rasher) and this compared with the live pig means one which is not too deep at the time of slaughter and one which has a clear cut straight underline; such a pig will appear to be long for its weight. One requires the type of pig which at bacon weight has only just begun to deepen; otherwise it is likely to be deficient in thickness of streak, for this is partly a question of maturity.

The shoulder is a low priced part of the carcass compared with the loin, and should be reduced as far as possible.

A coarse-skinned pig grows a thick rind which detracts from the bacon when it comes to be sold—hence the skin should be of fine texture. Many of these qualities cannot be determined until after the pig is slaughtered. Testing the offspring of breeding stock for carcass quality, and using the parents of those which test out best as the foundation of the next generation of breeding stock (and they should be kept and used as long as possible for producing breeding stock) is the only means of ensuring a sound breeding policy. It is important when these tests are being made that the nutrition should be suited to develop the characteristics that are required. Otherwise little progress will be made by selection, for the quality selected will be limited by the nutrition and not by the breed qualities of the animal.

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Spraying Oil Concentrates.

F. B. COLEMAN, Officer in Charge, and R. A. TAYLOR, A.A.C.I., Inspector and Examiner, Seeds, Fertilisers, Veterinary Medicines, Pest Destroyers, and Stock Foods Investigation Branch.

OWING to frequent enquiries received by this Branch with respect to types of spraying oils on the Queensland market, it has been considered advisable to publish this article, which may be defined as:—

A classification under the definitions prescribed by the Pest Destroyer Regulations, of the Spraying Oil Concentrates registered for the current year under the Pest Destroyers Act.

The Pest Destroyer Regulations prescribe standards for spraying oils and emulsions as follows:—

(*a*) Light mineral oils and/or emulsions shall consist of preparations containing benzine, benzole, petrol, kerosene, and other light oils which will readily form an emulsion with distilled water.

(*b*) Heavy mineral oils and/or emulsions shall consist of any preparation containing a heavy mineral oil which will readily form an emulsion with distilled water.

(*c*) Tar oils and/or emulsions.

The spraying oils registered for the current year may be divided into these three classes, as set out in table 1.

All of these oil concentrates are in a form which, on the addition of water, gives an emulsion.

Some may be ''concentrated'' emulsions, consisting of oil, water, and an emulsifier or emulsifiers; others may be ''miscible oils,'' consisting of oil and an emulsifier—without water.

The thorough preparation or emulsification of these concentrates by the manufacturer is an important factor controlling the fineness of division and permanency of emulsion obtained on dilution; of course the emulsifiers used are also of importance.

As may be seen from table 1 almost all of the spraying oils registered contain as the active constituent heavy mineral oil, and consequently fall into class (*b*) of the table in question.

The mineral oil used in this class of spraying oils falls into three distinct groups:—

(1) White oil;
(2) Red oil;
(3) Crude oil.

White oils, although they may in any particular oil concentrate consist of a ''blend'' of several ''named'' oils, are pure mineral oils. Generally speaking, they are safer to use than red oils with respect to plant injury, but the properties of the emulsions made from different white oils vary according to the physical properties of the oil or oils and other factors involved (such as emulsifier, &c.).

For instance, certain white oil concentrates are recommended as ''dormant sprays,'' whereas the majority are recommended for ''all the year round'' application.

TABLE I.

Class.	Name of Spraying Oil Concentrate.	Constituents Declared.		Queensland Primary Dealer.
		%		
(a)	Light Mineral Oils—			
	Irving's prepared Soluble Spraying Emulsion	62	Kerosene*	John Irving and Sons, Mayne
(b)	Heavy Mineral Oils—			
	Albarol White Oil	83·4	Petroleum Oil (Heavy)	Buzacotts (Qld.) Ltd., Brisbane
	Clarifol	82	Mineral Oil (S.G. ·890)	Neptune Oil Co., Ltd., Brisbane
	C.O.D. Improved Red Oil	75 7	Mineral Oil Cresylic Acid	The Committee of Direction of Fruit Marketing, Brisbane
	Cooper's Alboleum	80	Hydrocarbon Oil	Queensland Fruitgrowers' Society, Ltd., Brisbane
	F.D.L. White Oil	80	Mineral Oil	Fertiliser Distributers Pty., Ltd., Brisbane
	Gargoyle Red Spraying Oil	85	Red Mineral Oil (S.G. ·925)	Vacuum Oil Co., Pty., Ltd., Brisbane
	Gargoyle White Spraying Oil	85	White Oil	Vacuum Oil Co., Pty., Ltd., Brisbane
	Harbas	75 5·5	Total Mineral Oils (S.G. ·93) Tar Acids	Buzacotts (Qld.) Ltd., Brisbane
	"Neptune" Prepared Crude Spraying Oil	83	Crude Petroleum Oil (S.G. ·948)	Neptune Oil Co., Ltd., Brisbane
	"Neptune" Prepared Red Spraying Oil "A"	85	Mineral Oil (S.G. ·910)	Neptune Oil Co., Ltd., Brisbane
	"Neptune" Prepared Spraying Oil "C"	65 7·5	Mineral Oil (S.G. ·920) Cresylic Acid	Neptune Oil Co., Ltd., Brisbane
	"Neptune" Prepared White Spraying Oil	82	Mineral Oil (S.G. ·87)	Neptune Oil Co., Ltd., Brisbane
	Q.F.S. Red Spraying Oil	80 5·5	Mineral Oil Tar Acids	Queensland Fruitgrowers Society, Ltd., Brisbane
	Shell P.C.S.	83	Crude Petroleum (S.G. ·948)	The Shell Co., of Australia, Ltd., Brisbane
	Shell Red Spray	85	Mineral Oil	The Shell Co., of Australia, Ltd., Brisbane
	Shell White Spray	82	Refined Petroleum Oil	The Shell Co., of Australia, Ltd., Brisbane
	Shellicide "D"	82	Refined Petroleum Oil	The Shell Co., of Australia, Ltd., Brisbane
	United Red Oil Spray	75 7	Mineral Oil Cresylic Acid	United Chemical Co., Ltd., Brisbane
	Vallo Prepared White Oil	89	Mineral Oil	A. Victor Leggo and Co., Pty., Ltd., Brisbane
	Vallo Red Spraying Oil	89	Red Oil	A. Victor Leggo and Co., Pty., Ltd., Brisbane
	Volck	80	Refined Petroleum Oil	A.C.F. and Shirley's Fertilizer Ltd., Brisbane
(c)	Tar Oils—			
	Coopers Ovicide Tar Oil	48 20 10	Tar Oils Mineral Oils Phenols	Queensland Fruitgrowers' Society, Ltd., Brisbane

All percentages declared under the Pest Destroyers Act and Regulations must be weight to weight.

* The Specific Gravity of Kerosene is approximately ·80.

S. G. Specific Gravity.

Red oils are more impure than white oils, and may be refined into white oils.

Crude oil is crude petroleum oil; the use of this product naturally requires more careful control than is necessary with the above oils.

Generally speaking, the specific gravity of the above oils is greatest in crude oil and lowest in white oil; in other words, the specific gravity is lowered by the "refining" process.

A subdivision of class (*b*) of table 1, with respect to the type of oil contained, is set out as follows:—

TABLE II.

Class (b) Subdivision.	Name of Spraying Oil Concentrates.	Specific Gravities of Oils Present as Declared on Respective Labels.
(1)	White Oils—	
	Albarol White Oil	..
	Clarifol	·890
	Coopers Alboleum	..
	F.D.L. White Oil	..
	Gargoyle White Spraying Oil	..
	"Neptune" Prepared White Spraying Oil ..	·870
	Shell White Spray	..
	Shellicide "D"	..
	Vallo Prepared White Oil	..
	Volck	..
(2)	Red Oils—	
	C.O.D. Improved Red Oil	..
	Gargoyle Red Spraying Oil	·925
	Harbas	·930
	"Neptune" Prepared Red Spraying Oil "A" ..	·910
	"Neptune" Prepared Spraying Oil "C" ..	·920
	Q.F.S. Red Spraying Oil	..
	Shell Red Spray	..
	United Red Oil Spray	..
	Vallo Red Spraying Oil	..
(3)	Crude Oil—	
	"Neptune" Prepared Crude Spraying Oil ..	·948
	Shell P.C.S.	·950

It will be seen from the above that by subdivision into white, red, and crude oil sprays, the concentrates are also subdivided in accordance with the specific gravities of the respective oils contained in them.

It should be noted that in table 1 a number of the oil concentrates are shown as containing cresylic acid as well as mineral oil.

It is not advisable to classify these oils according to the presence or absence of cresylic acid or other tar acid, as this material is not necessarily an "active constituent," but is added as an emulsifier. When comparatively large quantities are present, however, the declaration of same is set out on the label for the information of the purchaser.

A dividing line has been drawn at 3·1 per cent.; consequently spraying oil concentrates having less than 3·1 per cent. by weight of cresylic acid do not declare on their respective labels the presence of such tar acid, while concentrates containing 3·1 per cent. or more disclose this fact.

For the purpose of this article, only materials specially prepared as "spraying oil concentrates" are considered; no recognition is made of pest destroyers which claim "spraying oil uses" as one of many properties.

Summary.—Spraying oil concentrates may be divided first into three classes:—

(*a*) Those containing light mineral oils (kerosene, &c.).

(*b*) Those containing heavy mineral oils.

(*c*) Those containing tar oils.

Class (*b*) contains the bulk of the spraying oils sold in Queensland.

This class may then be subdivided into—

(1) Those containing white oil;

(2) Those containing red oil.

(3) Those containing crude oil.

White oils are "pure" oils, and red oils are purer than crude oils.

The *active constituent* in "spraying oil concentrates" is the oil, and where cresylic acid is declared on the label, this is done because such tar acid, although used as an emulsifier, is present in comparatively large quantities, and this information is considered of use to the purchaser.

GRANADILLA GROWING.

In the growing of granadillas it is most essential that suitable trellising be erected to carry these plants.

The most successful method noted is to plant cuttings (decidedly preferable to the planting of seed) in the field at a distance of 16 feet between each cutting in the rows, and 6 to 8 feet between each row. A wise plan is to plant a greater number of cuttings in each row than are actually required, the grower removing any surplus after a reasonable period has elapsed, such period being long enough for these young vines to take root, and thus establish their certainty of growth. It is necessary for these vines to be trained up on to a trellis and a trellis is erected above them in the following manner:—

Two straining posts, one at each end, are very securely erected. Supporting posts are placed between these two posts at intervals of from 12 to 14 ft. The main wire is strained through the middle of these posts at approximately 5 ft. from the ground. At the top of each of these posts an arm is fastened (a piece of 3 x 2 timber 3 ft. long is ideal for this purpose). Two holes are bored, one in each end), and two additional wires are strained through these holes, thus making a 3-wire trellis to carry the vines.

It is imperative that these vines be trained so that the main leader grows along each of these wires, and it is preferable to have all vines running in the one direction.

Under tropical conditions these vines should come into fruit in approximately eight months. The first crop would be somewhat light; the second crop should be much heavier, and from then on these vines should produce two crops per annum.

The amount of fruit produced is greatly increased if hand pollination is adopted, and although this is quite a tiresome and difficult procedure it gives results that easily repay the grower.

It is particularly hard to estimate the actual weight of fruit produced per acre per annum, as so many factors are responsible. The best granadillas produced in Queensland are from vines growing on the rich alluvial lands just north of Cairns, and fully considering this fact it would appear that in districts as far south as Mackay similar returns would be obtained.

Spray Irrigation.

H. W. KERR.*

SPRAY irrigation has been employed successfully with many crops, notably vegetables, small fruits, and lucerne. With sugar-cane it has received only scant attention, although quite an extensive system was seen on one of the plantations of Hawaii ten years ago, when experiments were also being conducted at the Waipio Sub-station of the Hawaiian Sugar Planters' Experiment Station. The chief drawbacks to the wider employment of the system were (1) the cost of the installation, (2) the faulty distribution of water due to inherent imperfections in sprinkler design and interference from wind.

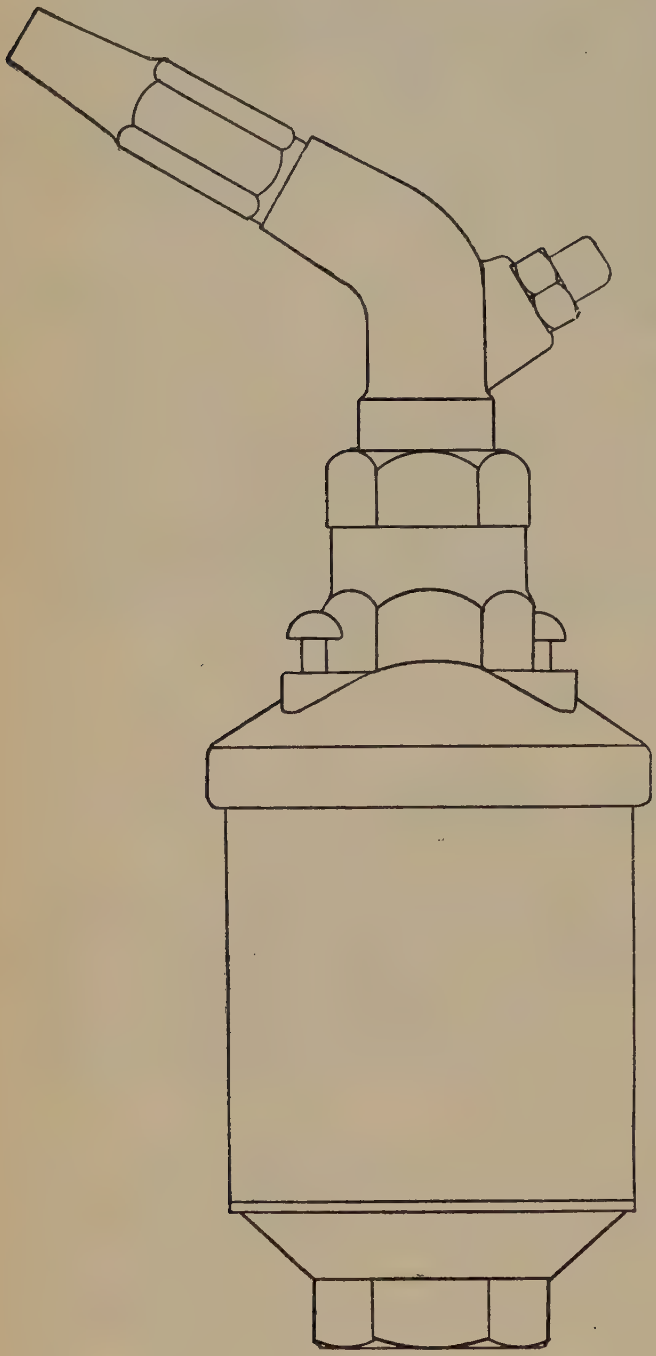

Plate 87.
Illustrating the high-coverage irrigation sprinkler.

At about that time the Thompson Manufacturing Company of California became interested in the problem, and devoted attention to the possibility of supplying a satisfactory sprinkler of wide coverage, so as to reduce the amount of pipe line required. The reduction in the number of sprinklers per acre demanded, of course, increased nozzle size and operating pressure to enable a given amount of water to be applied in reasonable time. The first model developed (Plate 87) was partially successful, and the number of sprinklers per acre was reduced to less than nine. More recently, a further improvement in design has permitted the production of sprinklers with the following characteristics:—

	Sprinkler (*a*).	Sprinkler (*b*).
Diameter of nozzle	⅜-inch	7/16-inch
Discharge of sprinkler	29 G.P.M.	42 G.P.M.
Nozzle pressure	45 lb.	60 lb.
Sprinklers per acre	3·0	2.37

The greatly improved coverage provided by this system allows of big reduction in the amount of piping required, although this is, naturally, of larger diameter. At the same time it permits of the pipe line being laid on the land surface without seriously interfering with cultivating operations.

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* Reprinted from the "Cane Growers' Quarterly" by courtesy of Dr. Kerr, Director, Bureau of Sugar Experiment Stations.

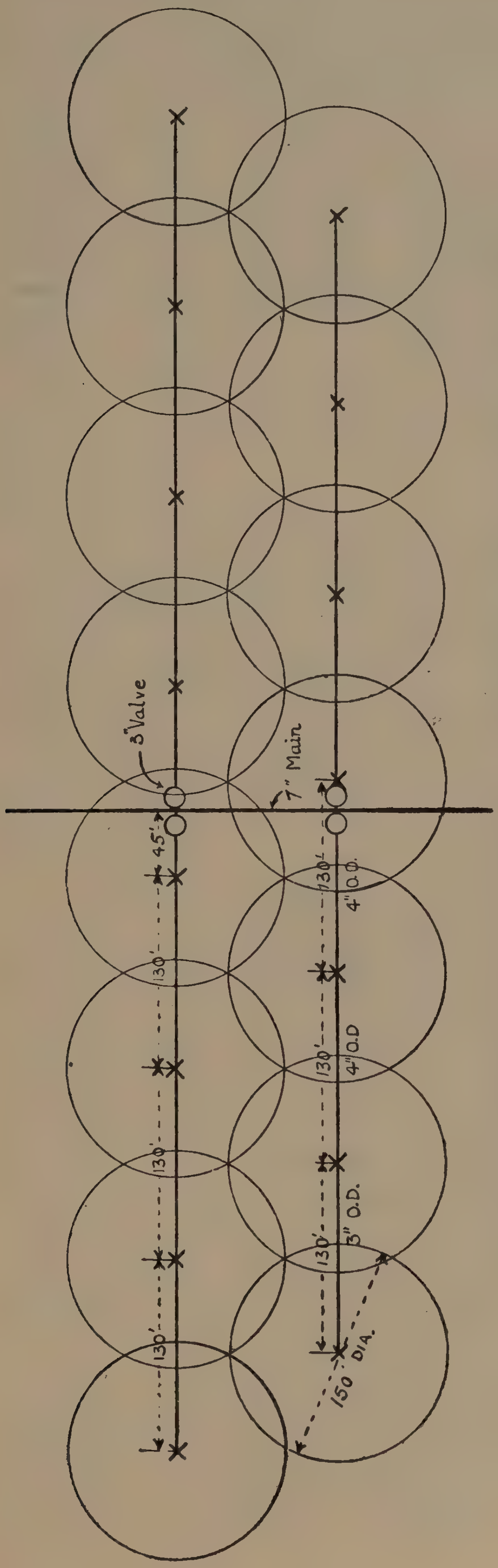

Plate 88.—Illustrating the Arrangement of Pipe-lines and Sprinklers for a 5-acre Unit.

The Sprinkler.

The construction of the sprinkler is such as to ensure positive action; that is, the slow speed at which the nozzle must revolve is achieved by a small water wheel placed horizontally in the base of the sprinkler, which is operated at a high speed by the large volume of water which passes it. By means of a series of gears, packed in a watertight case filled with grease, the positive drive is transmitted to the nozzle through a reduction of 3,750 to one. The nozzle then revolves once in two minutes, and there is but slight danger of failure.

The sprinkler is provided with two jets—the smaller delivers a fan-like spray, which covers a circle adjacent to the standpipe; the larger takes care of a wide ring surrounding this circle. Together these provide a coverage over a circle 150 feet in diameter in the case of sprinkler (*a*), when set on a standpipe 30 feet high. This installation was designed essentially for banana plantations, and for cane growing the height of the standpipe would probably be reduced to 18 to 24 feet, depending on the habit of growth of the variety; a reduction in height would, of course, substantially affect the coverage.

The Installation.

Plate 88 supplies the essential data for one unit of a large installation employing sprinklers of ⅜-inch nozzle diameter. This unit is 5 acres in extent, and all sprinklers are operated simultaneously.

The pipe consists of black steel piping with outside diameters (O.D.) as shown; it is specially bevelled for welding in the field. Welding results in a reduced installation cost, but increases the difficulty of moving the pipe line later. The standpipes (Plate 89) consist of 10 feet of 2 inch, 10 feet of 1½ inch, and 10 feet of 1¼-inch piping screwed together. The following are the costs supplied by the American Company:—

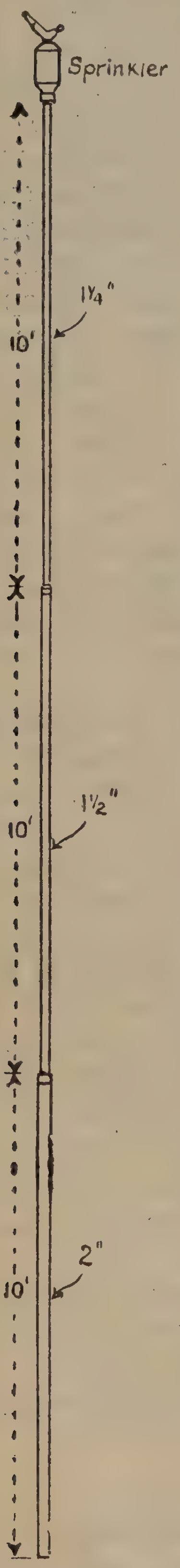

Plate 89.—Illustrating the Standpipe and Sprinkler Set-up.

		$	$
Plain steel pipe 7 in. O.D.,	220 ft. @	0·72	158·40
Plain steel pipe 4 in. O.D.,	1,170 ft. @	·27	315·90
Plain steel pipe 3 in. O.D.,	520 ft. @	·18	93·60
Screwed stand pipe 2 in.	150 ft. @	·19	28·50
Screwed stand pipe 1½ in.	150 ft. @	·14	21·00
Screwed stand pipe 1¼ in.	150 ft. @	·12	18·00
15 super rotor sprinklers	@	10·40	156·00
4 3-in. iron clamp gate valves	@	9·20	36·80
Material for 5-acre unit		=	828·20
1 acre		=	$165·64

Allowing $4·00 as equal to £1 Australian currency, the cost of the material for this installation on the above values would be about £41 10s. per acre. To this must be added the cost of installing a suitable pump and engine. A two-stage centrifugal pump will be necessary to provide the high nozzle pressure required, and take care of friction losses in the pipe line. These have been estimated as follows:—

	lb.
Nozzle pressure	45
Loss of head in lateral	6
Loss of head in elevation of sprinkler ..	13
Loss of head in standpipe	2
Loss of head in 2,000-ft. main	17
Minimum pressure at pump ..	83

Provision must be made also for the suction and delivery head involved in raising the water from the spear or well to the land surface. On the above figures it is estimated that an engine of 40-h.p. would be necessary, operating a 5-inch pump.

With fifteen sprays working at the same time and delivering ¼-inch per hour, a 3-inch watering will be completed in twelve hours. From these figures it may be calculated that 429 sprinklers will water 143 acres in fourteen days if the unit be operated twenty-four hours per day.

With a similar installation employing the nozzles of 7/16-inch diameter, a 70-h.p. motor will enable 429 sprinklers to water 181 acres in fourteen days (twenty-four hours' operation). The cost of the pipe line installation would be practically the same as the alternative scheme described.

Unit Installed at Ayr.

During the past year a small spray system employing these imported sprinklers was laid out at Ayr. Although one object of the layout was to determine the practicability of spray irrigation, it should be made quite clear that the main purpose was the provision of a scheme which would permit of accurately controlled water application for irrigation experimental work, which it is hoped may be carried out at this centre.

Through the courtesy of Messrs. Landa and Co., an area of about 3 acres of land was made available for our use. A well was sunk, and a 2½-inch two-stage pump, operated by a 15-h.p. electric motor, was supplied from a 6-inch slotted brass spear. A 3-inch diameter galvanised pipe line (Plate 90) carried the water to the edge of the field, where the line was divided into two branches, each carrying six sprinklers. As the standpipes were reduced to 18 feet in length, the distance between sprinklers was fixed at 110 feet, with 100 feet between the pipe lines. This installation was capable of operating three sprinklers simultaneously. With this arrangement it required three hours to apply 1 acre-inch of water.

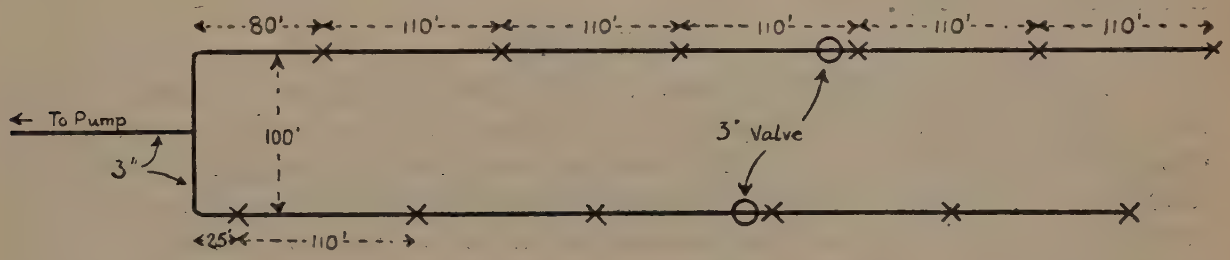

Plate 90.—Plan of the Pipe-line System installed at Ayr for Experimental Purposes.

Our first experiment was designed to determine the effect of the amount of irrigation water applied at each watering. One-half of the area received 2 acre-inches, and the other 3 acre-inches. The intervals between applications varied with the season of the year—from three weeks in the cooler months of slow growth, to nine days in the months of December, January, and February—the season of vigorous growth.

The spring and early summer months were unusually hot and dry, even for this district, and it was early evident that, under these conditions, the 3-inch application was much superior to the 2-inch watering. The full details of the experiment will, however, be deferred until the crop is harvested.

It was found that wind interfered seriously with the evenness of water distribution, and for experimental purposes it was found necessary to conduct the watering during the night hours. Under still atmospheric conditions, measurements made with a series of tin cans spaced over the field showed that the distribution was quite good. For a 3-inch application, for example, the measurements ranged from 2¾ inches to 3¼ inches. In spite of the dryness of the season, little in the nature of dry spots could be detected in the crop growth, which could not be explained by visible soil variations.

Advantages and Disadvantages of the System.

The following summarises the main advantages and drawbacks of spray irrigation:—

Advantages.

(1) Economy in water utilization due to evenness of distribution of even light applications.

(2) Complete elimination of seepage losses from drains.

(3) Reduction in water distribution costs with respect to (*a*) labour in watering, (*b*) labour and implements in forming water-furrows.

(4) Flat cultivation is possible and an increased number of ratoon crops should be profitable.

(5) Trash conservation may be practised with ease.

(6) Fire protection, as sprinklers may be operated to control accidental burning.

Disadvantages.

(1) High cost of installation. On figures supplied recently by a Brisbane firm, threaded black steel tubing similar to that specified would cost about £39 per acre, to which should be added the cost of sprinklers. The cost per acre could be reduced somewhat if the sprinklers were transferred from field to field as required. It is estimated that the steel pipe line, if laid on the surface of the soil, should have an average lifetime of twenty-five years.

(2) High pressures, necessitating an increase in engine power over that normally employed. This would be partially or possibly completely off-set by the reduced volume of water required, with even distribution and elimination of seepage losses.

(3) Moving of pipe line when ploughing. This could be eliminated almost entirely if the main were buried to a depth of 12 to 15 inches, and ploughing confined to the area between surface laterals.

Conclusion.

The results obtained from the trial plot installed by the Bureau at Ayr should, in the course of two or three years, supply data which will permit of a true estimate of the value of spray irrigation. The financial outlay must, however, always remain a serious obstacle to its extensive adoption.

SULPHATE OF AMMONIA—DOES IT EVAPORATE?

This is a question which we are repeatedly asked, despite a detailed discussion of the point in an earlier issue. We would repeat that it may be applied quite safely in dry weather, and it will be taken into the soil by the first rains or even by the dew.

Further, it is not necessary to throw the material into the stool. It is much simpler and just as good to apply alongside the stool; and one-side application is just as good as uniform distribution on both.

H.W.K. in the "Cane Growers' Quarterly."

Alternative Crops for the Canegrower.

H. W. KERR.*

THE canegrower is constantly reminded of the dangers which beset the farmer who is entirely reliant on one crop for his livelihood. At the present time excess sugar production, which results in the disposal of a large proportion of the crop at a value below production costs, renders it more important than ever to seek for alternative crops, for which there exists a ready market, and thus relieve the pressure which at present threatens the existence of many of our growers.

Another aspect of this problem is one which affects the future of Queensland agriculture in its broadest sense. Doubtless the arable lands of our coastal plain must ever constitute the most valuable agricultural areas of the State, and the future of primary production in Queensland appears bound up in the intensive development of this limited tract. Despite popular supposition to the contrary, the major proportion of these good-quality lands has already been brought under cultivation, while the best of these are devoted at the present time to cane culture. The value of intensification of production in reducing unit costs in a country which demands a living wage for its workers, has been repeatedly demonstrated; and a broad review of the question along these lines suggests a solution of the canegrowers' problem, while providing a brighter outlook for the general agriculture of the State.

Due to the uncertainty of rainfall incidence, even in parts of this comparatively humid coastal plain, intensive methods cannot be initiated successfully without the aid of irrigation. What can be achieved where adequate water is available is exemplified by recent developments on the large sugar plantations of Southern Queensland; and results have demonstrated that while assuring the desired crop, production costs are also reduced. By the full development of all available irrigation resources in these districts, similar results could be achieved on substantial areas of the coast. Production control could then be effected with safety and certainty, and it is reasonable to predict that with the assistance of irrigation, the acreage now devoted to cane on such areas could be more than halved, with no reduction in crop harvest. The release of this area of good-quality land for alternative crops, also by irrigated methods, would serve to provide the outlet for an increased farming population, and the relegation of marginal lands to their true position in the economic scheme.

As an illustration of how such a project could be brought into operation, we might consider the red volcanic soils of the Woongarra area, Bundaberg. Some few years ago, serious consideration was given by the growers of that district to the development of an ambitious irrigation scheme, whereby water from the Burnett River would be diverted to this area. As is general with all large irrigation schemes, the initial installation cost would be high, though it was estimated that water could be delivered to all farms in the benefited area for approximately £5 per 1,000,000 gallons. The proposal was finally rejected on the grounds that intensification of cane production would but lead to further embarrassment, as the average crop production under natural rainfall conditions is sufficient to supply ''peak'' crops to the local mills. Apparently, little or no consideration was given to the possibilities of other crops.

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* Reprinted from the ''Cane Growers' Quarterly'' by courtesy of Dr. Kerr, Director, Bureau of Sugar Experiment Stations.

At this time, a small irrigation plant was installed at the Bundaberg Experiment Station, for the purpose of studying irrigation problems on the red volcanic soil, and allowing us to gather information regarding the possibilities of intensive production on this valuable soil type, of which the chief drawback is its low water-holding capacity and droughtiness. Our cane experimental plots have already demonstrated the true potentialities of the land, when the natural soil moisture deficiency is overcome, and no difficulty is experienced in the economical production of a 60 or 70-ton crop of cane in sixteen months.

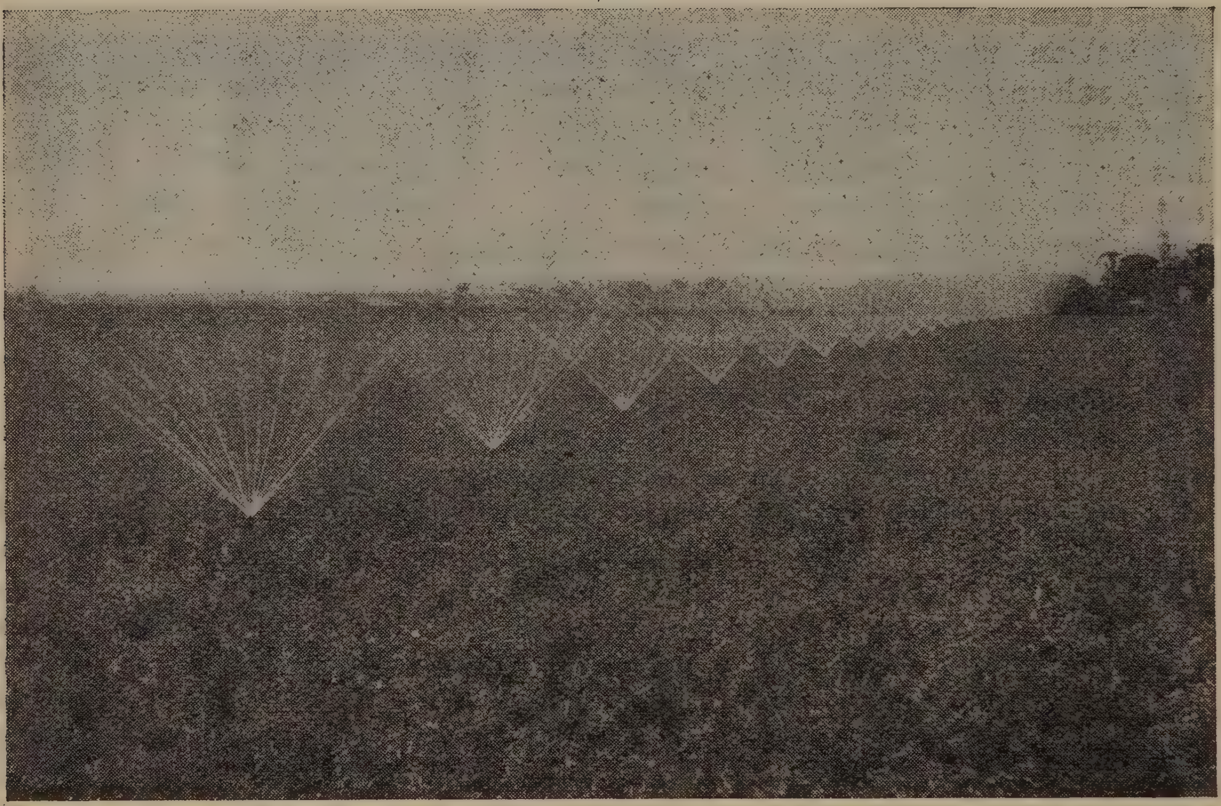

Plate 91.

Operation of the spray system recently installed for the irrigation of lucerne.

Attention was then turned to the possibilities of lucerne production, by watering. For years a lucerne block had been maintained on the station under dry land conditions, and we were generally well supplied with hay for our station horses; but by the use of a spray irrigation system (see Plate 91) some very interesting results were recorded during the past year. The old block was ploughed out, and after thorough preparation, was reseeded in April, 1935. A good stand resulted, and the first cut was made in August. This was allowed to lie on the field. Thereafter the block was irrigated as frequently as required, and cut whenever the crop had attained the desired growth stage. The following table summarises the history of the field for the year:—

Irrigated.	Crop Harvested.
	1. October 2nd, 1935.
1. November 13th, 1935	
2. November 26th, 1935	
3. December 8th, 1935	
	2. December 16th, 1935.
	3. January 28th, 1936.
4. February 3rd, 1936	
	4. Half February 18th, 1936. Half March 11th, 1936.
	5. Half April 6th, 1936. Half April 14th, 1936.
	6. Half April 14th, 1936. Half May 18th, 1936.
5. May 28th, 1936	
6. July 17th, 1936	
	7. Half July 29th, 1936.
7. August 7th, 1936	
	Half August 19th, 1936.

Plate 92.
A fine stand of lucerne on the Bundaberg Station.

In the first year of the stand it was therefore possible to harvest seven cuttings of lucerne, while seven waterings, each of 3 acre-inches, were given. It will be remembered also, that the past season was notable for its rainfall deficiency. Yield determination showed that somewhat more than 2 tons of *hay* per acre were obtained at each cutting, or a total of 15 tons per acre for the year. It should be pointed out that at no time was an attempt made to force growth to its limit, due to the superabundance of hay on hand, at all times, for horse feed. It is the opinion of Mr. N. J. King, who is in charge of this project, that no difficulty will be experienced in the coming year in producing 20 tons of hay per acre.

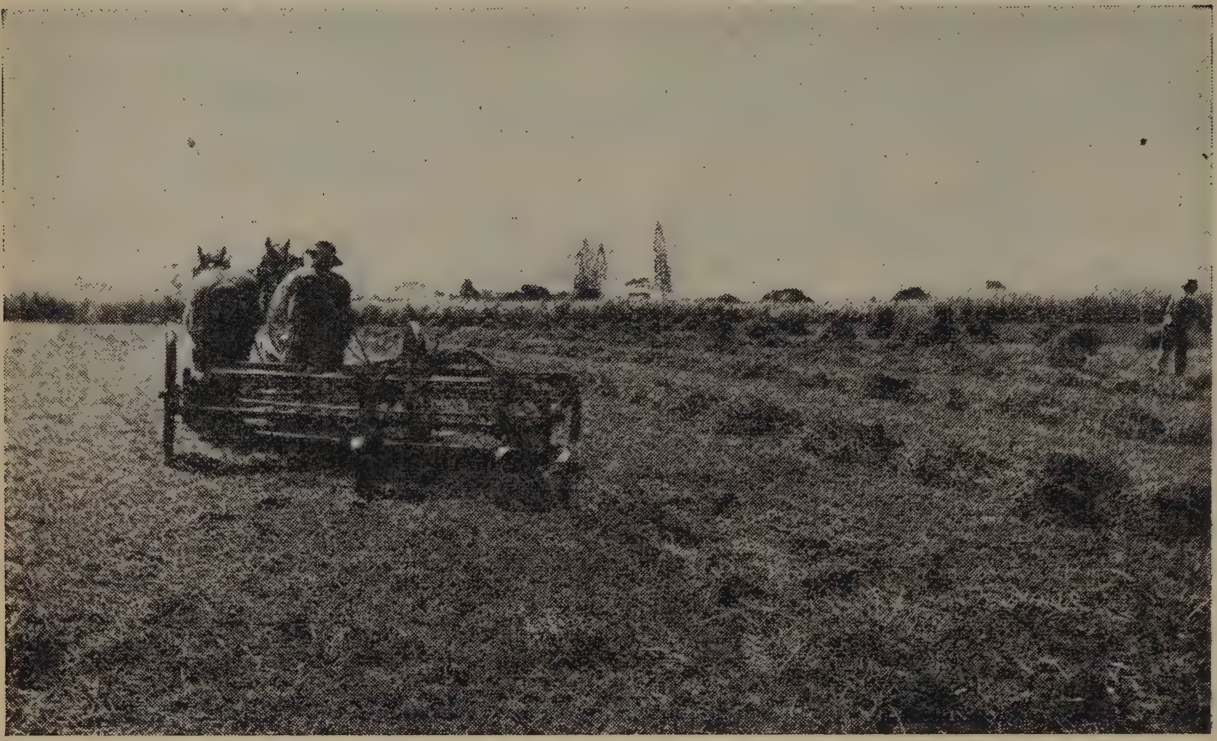

Plate 93.
Windrowing with the side-delivery rake.

The method of handling the crop is illustrated in Plates 93 and 94. The cost of handling the hay is substantially reduced by the employment of the side delivery rake in windrowing. Though the implement has also proven useful in cocking, it is found that this operation is best effected by hand.

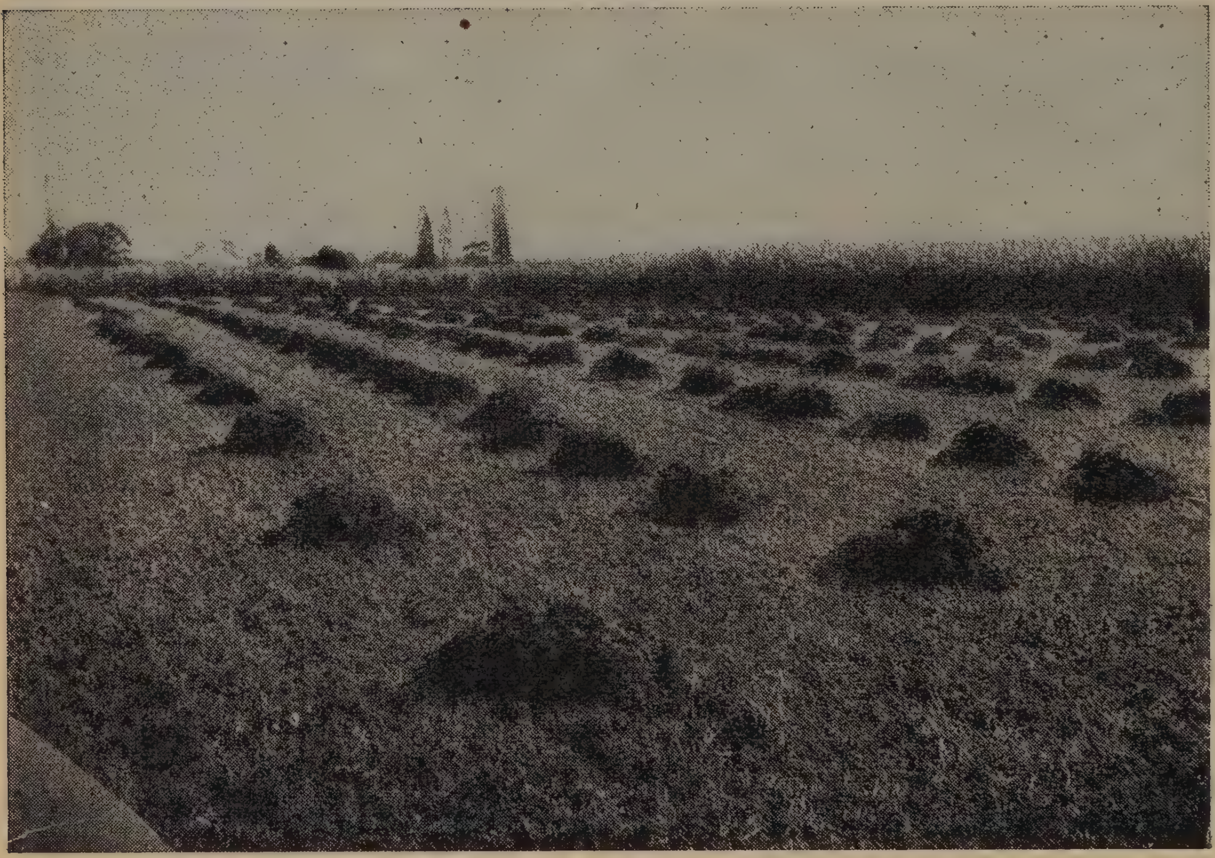

Plate 94.
The cured hay ready for transfer to the barn.

One must conclude, from the above results, that the red volcanic loam of the area is a first-class lucerne soil under irrigated conditions. At average market values for the hay, the gross return per acre would be in excess of £100 per annum, while in the absence of a market for the quantity of hay which might be produced, the development of a stock-fattening industry offers considerable promise.

The production of fat lambs, for example, is an industry for which a ready market is assured, both in Queensland and overseas. It is, therefore, of interest to examine the prospects which such a project would offer, when combined with canegrowing. For it provides a ready means of disposing of crop refuse (green tops), and a mill by-product (molasses) in a much more economical manner than it at present possible on a wide scale. It is suggested that the production of cross-bred lambs, by mating, say, a Dorset Horn ram with Merino ewes, would be productive of the best results under these conditions. The ration for the breeding ewes would be substantially lucerne hay, supplemented by cane tops (when available) or grass for roughage, and with the addition of molasses to supply any deficiency in carbohydrates. The lambs would be fattened rapidly on a similar ration, and marketed at the age of four-five months, when they should yield a dressed weight of from 30-32 lb. On dry land such as this, foot trouble and coastal parasites should be at a minimum, while with small flocks it would be practicable to deal readily with any complications from these causes. Should it be found undesirable to retain the ewes for more than a limited period, both ewes and lambs could be fattened and marketed.

In considering the cost and returns from such a scheme, the cost of labour has not been considered in detail. Doubtless, this would vary with the handling facilities available; but the following estimates of out-of-pocket expenses are presented to indicate the margin which the project offers. Costs are calculated on the basis of 100 ewes, producing eighty lambs.

Feeding costs.

Allowing 750 lb. lucerne hay per ewe per annum—

One hundred ewes will require 34 tons of hay; supplemented by 50 tons of cane tops, &c., as roughage, which would be yielded by 200 tons of well-grown cane.

Adding molasses to the above at the rate of ½ lb. per day, 8 tons of molasses would be required.

Allowing an average of 1 lb. lucerne hay per lamb per day, for four months—

Eighty lambs will require 4½ tons hay.

A molasses ration of ⅓ lb. per head per day, would consume 1½ tons molasses.

Summary.

	Tons.
Total lucerne hay	38½
Total cane tops, &c.	50
Total molasses	9½

Allowing £6 as the cost of 1,000,000 gallons of irrigation water, one half million would be used per acre per annum, at a cost of £3. On the basis of the lucerne yields suggested above, 2 acres would be necessary to supply the required hay. The cost of water would then be £6 per annum. For molasses, a value of £1 per ton, on the farm, might be allowed.

Summary of Above Costs.

Lucerne irrigation	£6
Molasses purchased	10
Fertilizer for lucerne block	5
	£21

Cost of marketing must also be added.

Return from Ewes and Lambs.

Eighty lambs at 20s. each	£80
Wool from 100 ewes at 8s.	40
Profit, from sale of fat sheep, at 4s. per head	20
	£140

In addition to any income which would be derived from this source, it must be borne in mind that the utilization of cane tops and molasses as feed would result in the economic disposal of these by-products, while the droppings voided by the animals would contain a large proportion of the plant-food materials contained in the feed, and would constitute a valuable manure for the cane lands.

It should be emphasised that the above suggestions are presented, not as a cure for the ills of excess sugar production, but merely as a line of thought which should interest those of our growers who are earnestly seeking some way out of our present difficulties. Moreover, while such schemes might be of value in the drier cane areas, the problem of the humid north offers greater difficulties.

◆

CROWN LAND FOR GRAZING HOMESTEAD SELECTION.

CUNNAMULLA DISTRICT.

The resumption from Cunnamulla Holding has been surveyed as portion 4, parish of Eunama, and is situated about twelve miles southerly from Cunnamulla.

It will be open for Grazing Homestead Selection at the Land Office, Cunnamulla, on Monday, 12th April, 1937, at 11 a.m.

The selection will be for a term of twenty-eight years, and the annual rent for the first period of seven years is 2¾d. per acre.

The selection must be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of three years.

The portion is good wool-growing country, and is well watered by four bore drains.

Free lithographs and full particulars may be obtained from the Lands Department, Brisbane, the Land Agent, Cunnamulla, and the Government Tourist Bureaux, Sydney and Melbourne.

Soil Erosion.

H. W. KERR.*

DURING recent months the subject of soil erosion has been given considerable prominence in agricultural discussions. Doubtless, it is one of the most serious agricultural problems with which a country is faced, and it is of national importance. It is, at the same time, one which is conveniently ignored by those who are most adversely affected by it, and the realization of its nature is truly appreciated only when the damage has been done. As with most other problems, methods of prevention are always simpler than cures. Since the question of soil erosion is a matter of decided importance to some of our valuable cane-growing areas, it would appear fitting to place before cane farmers a few observations on—(1) its causes, (2) its prevention, and (3) its cure.

The Causes of Erosion.

The term ''erosion'' means the loosening and removal of soil from its previous resting place, through the agency of wind or water. Insofar as the Queensland cane areas are concerned, the action of wind is of minor importance, and we will therefore confine our attention to water erosion. When rain falls on the land surface, a proportion is absorbed by the soil, while the balance flows away and ultimately finds its way to a neighbouring watercourse. Flowing water possesses the power of carrying with it a greater or less amount of solid matter, gathered from the surface over which it flows. The gradual removal of soil in this way, insignificant though it may appear in some circumstances, is one of the most potent forces in converting valuable land—and notably land of appreciable slope—to a state of low productivity. Water which percolates through the soil carries with it valuable plantfood materials which it dissolves. To replace these, the application of simple and appropriate fertilizers is sufficient treatment. But the removal of the solid soil particles by surface ''run-off'' water is something which cannot be so readily restored. It is common experience that the finest particles of the soil are those most readily removed in this way, and these materials also constitute the most fertile portions of the land. When a river carrying such sediments overflows its bank, its speed is checked and the suspended matter is deposited on the flood plain in the form of sediments, which eventually provide characteristically fertile alluvial soils.

The major factors affecting the intensity of erosion are—(*a*) Type of soil, (*b*) slope of the land, (*c*) farm management methods, (*d*) amount and rate of rainfall.

(*a*) Sandy soils are, in general, least subject to erosion, since they are capable of rapid absorption of water. But should conditions result in the creation of a fully-saturated sandy soil, the absence of binding material permits it to be carried down a slope at a very rapid rate; again, the coarseness of the particles may cause it to be deposited before it has travelled any great distance.

Heavy clay soils are more subject to gradual wearing down by water, but the strong cohesive forces which exist in such soils offers great resistance to loosening.

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* Reprinted from the ''Cane Growers' Quarterly'' by courtesy of Dr. Kerr, Director, Bureau of Sugar Experiment Stations.

The soils most liable to erosion are the intermediate class known as loams. When saturated with water they may move off in large masses due to their plastic nature. A loam rich in organic matter possesses advantages over those not so favoured, for this important soil constituent promotes more complete water absorption, while acting also as a mechanical obstruction due to its fibrous character. Unfortunately, few cane soils could be classed as rich in humus.

The presence of gravel and stones is sometimes helpful in preventing erosion, as they are themselves moved with difficulty; they also offer resistance to the free flow of water, and definitely protect the soil which lies beneath them.

(*b*) The steepness or "gradient" of the land has a very direct and obvious influence on the degree of erosion experienced. While silts are removed even by water flowing over relatively level land, the carrying capacity of flowing water increases at a very rapid rate with increased slope. This is very apparent when we study the rate of gully formation in a field. A series of measurements which were made to determine the influence of slope showed that, while 8,000 lb. of soil were removed annually from an acre of "level" soil, the rate of removal was doubled where the gradient was 1 per cent., and trebled where the slope was between 2 and 3 per cent. Steep slopes also affect the relative amounts of moisture absorbed and shed by the land.

(*c*) The nature of the surface of the soil is one of the greatest factors in determining the extent of erosion, and is indeed one of the major considerations in devising control measures. Soils in their natural condition possess a protective covering of forest, scrub, or natural grass, which prevents erosion on all but the steepest slopes. The removal of the vegetative cover, and particularly the subsequent tillage operations to which the land is subjected, results in a drastic disturbance of these natural conditions, and erosive factors are given full play. A loose layer of surface soil—particularly when underlain by a subsoil hardpan created by tillage implements—presents an ideal medium for the absorption of the first rains which fall, at least to the point where it becomes saturated. Should deep percolation of the excess moisture be hindered in some way, it requires little further water to cause the plastic surface layer to move down a slope, should this condition exist. The adverse influence of even surface tillage implements is readily seen on a tilled hillside field following heavy rains. The removal of the surface mulch layer reveals the tracks of the individual tynes of even the homely scarifier.

(*d*) It is readily evident that the rainfall rate is one of the potent factors in erosion. Heavy and rapid downpours inevitably cause greater removal of soil than an equal amount of rain falling over a longer period. This is due to the time factor which is involved in the moisture absorption rate for any soil, and the soil removal influence is thus bound up in the amount of run-off water. The state of the soil at the time a heavy downpour is experienced—whether it be relatively dry or already water saturated—is an important consideration. Heavy rains themselves beat and compact the surface soil layer and destroy in some degree the natural absorptive capacity of the land. In the coastal regions of Queensland, with their recurrent tropical deluges, the effects of erosion are widely evident even on relatively gentle slopes.

The character of the crop to which the land is devoted has a very marked bearing on the degree of erosion experienced. The following series of figures obtained from studies conducted in the middle west of the United States of America is very interesting in this connection:—

Soil Treatment.	Percentage of rainfall which ran off.	Total weight of soil removed per acre per year.
	Per Cent.	Tons.
Not cultivated	49	30
Ploughed 4″ deep	31	36
Ploughed 8″ deep	28	31
Grass sod	12	¼
Wheat each year	25	6
Maize each year	27	16

The slope of the land was slightly less than 4 per cent., and the annual rainfall varied from 24 to 50 inches over the duration of the experiment (6 years). Certain features of these results are worthy of note. Firstly, erosion was greatest on the loose, ploughed soil without crop. Secondly, the presence of a growing crop reduced the loss, and this influence was greatest with the crop which afforded the most complete cover. Maize—which might be compared with sugar-cane in this regard—reduced the erosion loss by one-half, wheat effected a reduction of five-sixths, while with grass sod an insignificant amount (¼ ton) of soil was carried away. In passing, attention should also be drawn to the loss of water due to run-off which occurred under the various systems of husbandry. The rate of soil removal on a well-tilled slope is commonly evidenced in our Queensland cane areas, when a deluge of rain is experienced during the planting season. How often the farmer awakes to find his soil and plants washed down to the low end of the block!

The Prevention of Erosion.

From the preceding discussion it may be concluded that soil erosion is caused by water running from higher to lower levels over the surface of the ground. Erosion control therefore consists in decreasing or diverting the run-off, or both. The possible methods are—

(1) Reducing the run-off by making the soil more readily absorbent.

(2) Keeping the soil covered; a good vegetative cover also slows down the run-off and causes more water to be absorbed.

(3) Holding and diverting the water along courses having such a gradient that the erosion damage is negligible. This principle is employed in terracing.

(4) Conveyance of water from higher to lower levels in artificial channels. This principle is generally applied in disposing of concentrated run-off from fields, and in checking deep gullying.

These several preventive methods will be discussed in some detail.

1. The absorptive capacity of the soil may be improved by sub-drainage. The growth of deep-rooted crops—*e.g.,* lucerne—will open up stiff soils and provide channels through which the water may pass. Deep ploughing and subsoiling or grubbing will also assist in increasing absorption. In ploughing on slopes, the furrow slice should always be thrown up-hill, by the use of a reversible hillside plough. Land left in this condition will always absorb more water than where the furrow slices are thrown down-hill. Contour ploughing is obviously better than ploughing up and down the slope for similar reasons. All methods of humus restoration are to be encouraged, slow though the process may be; a soil rich in organic matter will remain open and make for more complete rainfall absorption.

2. Unfortunately, the canegrower has little opportunity for keeping his land covered. Where crop rotation is the vogue, the farmer may keep his land under grass cover for a proportion of the rotation period; and the steeper the slope of the land the greater the proportion of the rotation during which grass cover should be kept. The canegrower has, however, two opportunities of doing something in this regard; during the fallow, a green manure crop should invariably be sown; where serious erosion losses are encountered, trash should *never* be burned but left on the land surface to serve as a mulch. The benefits of trash conservation are twofold—(*a*) the avoidance of ratoon cultivation leaves the soil undisturbed and reduces the rate of subsurface packing; (*b*) excess water is shed by the trash layer instead of by the loose soil, and, therefore, a sediment-free run-off replaces the normal sediment-laden stream. On certain farms in the humid northern cane districts, this practice is being employed systematically with very good results. Relieving of the trash from the stools promotes a more rapid ratooning, and facilitates the application of both mixed fertilizer and sulphate of ammonia.

Experience shows that land of greater slope than 5 per cent. should never be devoted to cultivated crops continuously; where the slope reaches 10 per cent. cultivated crops should occupy the land only during a small fraction of the rotation period, while land of more than 15 per cent. slope should be kept in permanent pasture. From these data it is evident that much land which is being cultivated at the present time will be *completely useless* in a few years. Unfortunately, no means are available whereby the farmer may be obliged to devote his land to those crops for which it is suited, and thus avoid the national calamity of denuded hillsides of waste land.

3. Where the methods hitherto discussed are not adequate or suitable for the purpose of effecting erosion control, the farmer must resort to terracing his land. Such a suggestion is generally dismissed by the farmer as something both costly to carry out and difficult to deal with. A careful study of the accompanying notes will show, on the contrary, that terracing may be effected at very little cost, while its presence is scarcely noticed during subsequent cultural operations.

The terrace is a flat ridge of earth like a steeply-graded road or an extra large back-furrow, from 15 to 20 feet wide at the base, and built almost on contour lines around the slope. Above this ridge is a flat, broad channel. The crest of the terrace is 15 to 24 inches above the bottom of this channel. Terraces control the run-off, because they are spaced in a series like steps down the slope, each taking its share of water before the total quantity becomes large enough to do damage. The water which each traps is carried in a broad slow-moving stream to the side of the slope without damage to the field. This slow movement keeps the water in the field for a longer time, causing more of it to be absorbed into the land, and reducing run-off and loss of soil by erosion. Reference to the accompanying sketch (Plate 95) together with a detailed description of the process of terrace construction should make these points clear.

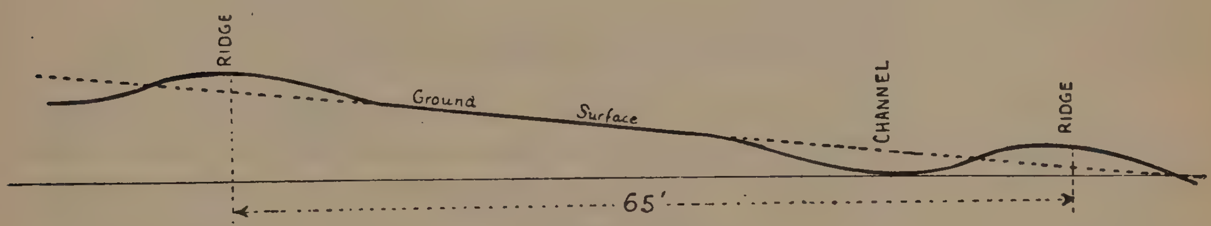

Plate 95.

Showing the cross section of a terrace on a slope of 10 per cent. Under these conditions terraces will be formed at intervals of 65 feet down the slope.

Terraces are constructed in such a direction across the slope of the land that they provide a fall of not more than 6 inches in 100 feet. They are spaced so that each will take care of the water which falls between it and the one above; they must be close enough together so that the run-off water from average storms will not have an opportunity to descend in small rivulets between the terraces. Where the slope is slight, practically all sediment carried to the terrace under abnormal conditions will be deposited immediately. The most suitable distance between terraces is governed by the slope of the land and the soil type. As a rule, there should be a vertical fall of from 4 to 6 feet between terraces on land with a grade of from 5 to 10 per cent. A greater vertical distance should be allowed where the slope is greater.

The most suitable distance between terraces is shown in the following table:—

Slope of Land.	Vertical Drop between Terraces.		Distance between Terraces along Slope.
Per cent.	Feet	inches.	Feet.
3	3	0	100
5	4	3	86
8	6	3	78
12	7	0	58

The gradient along the terrace is also governed by the length of the terrace and the natural slope of the land; the following table offers a useful guide in this respect:—

Length of Terrace.	Gradient per 100 feet along Terrace where Land Slope is.		
	5 Per Cent.	10 Per Cent.	15 Per Cent.
Feet.	Inches.	Inches.	Inches.
0 to 300	½	¾	1
300 to 600	1	1½	2
600 to 900	2	3	4
900 to 1,200	4	6	7
1,200 to 1,500	6	..	..

In staking out the terraces a home-made level is useful (Plate 96). It is constructed in such a way that one leg is shortened or made adjustable, so that the correct fall is obtained when in the "level" position, as shown by the bob or spirit level. Thus if the span be made 16 feet 8 inches six steps will be required per 100 feet of terrace; hence, to strike a fall of 6 inches in 100 feet, one leg should be made 1 inch shorter than the other.

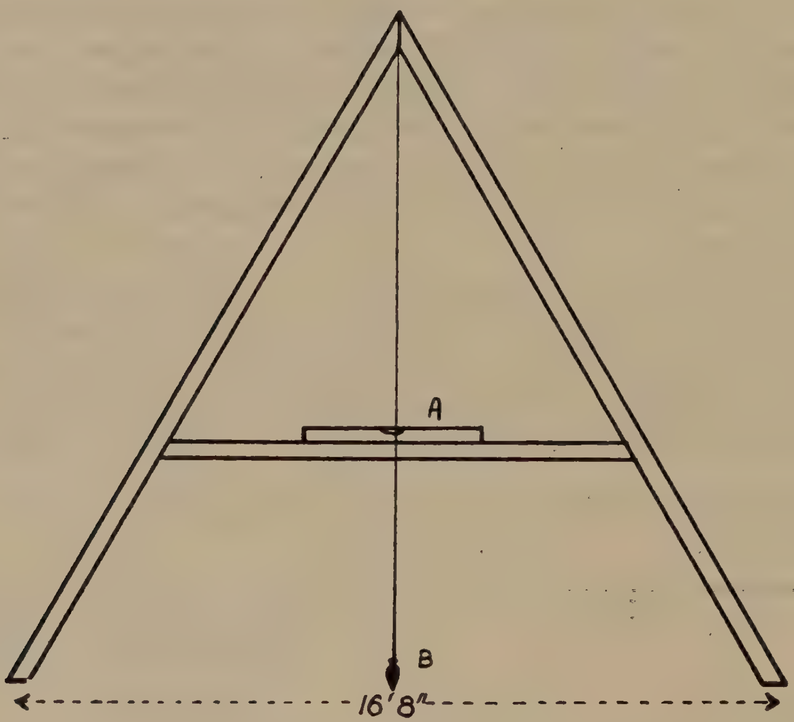

Plate 96.

Illustrating the home-made leveller for use in laying out terraces. Either spirit level (A) or bob (B) may be used.

The first step in the construction of the terraces is to find a suitable outlet for the water which will be discharged at either end of the terrace. A well-sodded pasture is best. Care should be taken that any gully into which the water is discharged is protected against erosion, using saplings or rocks where necessary (Plate 97), whilst at times earth dams may be necessary. The point at which a terrace crosses an intermediate small gully must be higher and stronger than at other points to eliminate the danger of the water breaking through. The top terrace is made first, and should be built up sufficiently high, so that water from higher up will not collect and break across it before it has settled. An ordinary swing plough may be used to mark out the line of stakes on the terrace; the stakes may then be used in setting out the next one below. It is important to exercise care in laying out the terraces accurately.

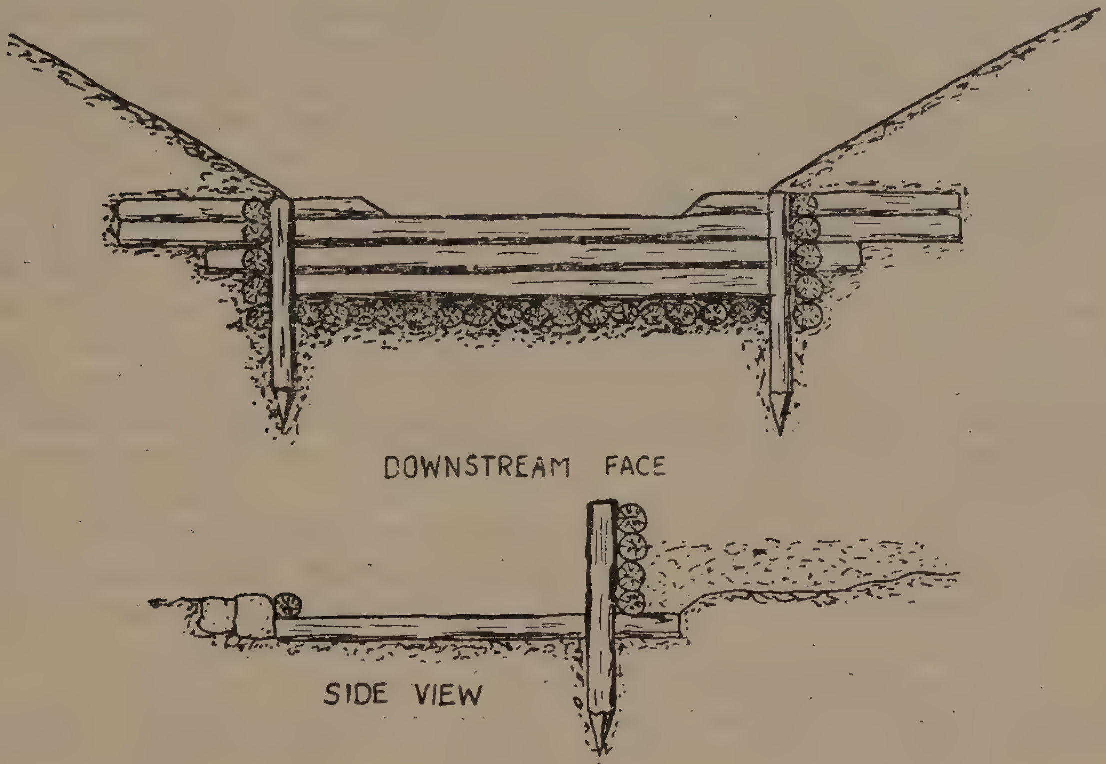

Plate 97.

A suitable type of log dam which may be built across a gully. The apron of timber effectively prevents erosion by the falling water.

The terrace is built up first by means of a team and plough, and later by the use of a light road grader or V-shaped drag. Very little ploughing is necessary in light soils. It is customary to throw together six or eight furrows, and then push the soil towards the centre by means of the grader. This process is continued until the top of the terrace is 12-18 inches higher than the lowest point above the terrace—that is, in the water channel. When completed the terrace should be fairly compacted, and no low points should be left. It is important to build sufficiently highly over low places or small gullies.

During subsequent ploughing and planting operations, the contours should be followed; if the slope is less than 8 per cent., and the terraces are well established, they may be ignored in all cultural operations. When crossing the terrace it is an advantage to plough slightly shallower so that the bank is not weakened early in its lifetime. It is advisable to pay careful attention to the terraces during their first year, so that any break may be repaired as it forms. It is best to throw a little soil on to the terrace when ploughing, and the channel on the upper side of the ridge must be kept clear. For safety sake, the land should first be devoted to grass or to a cover crop of peas or beans to give it the best opportunity to consolidate.

Although terracing has not been exploited in the Queensland cane areas, it is a practice worthy of the closest consideration by growers who are farming high slopes. The cost of the work in the American states is about 10s. per acre, which is certainly not excessive. The farmer should take care that the work is carried out after the risk of heavy rains is past—that is, during the autumn or winter months. The terraces will then have an opportunity of settling down by the late spring, when a cover crop of legumes may be planted to protect the terrace during its first wet season.

Cure of Erosion Damage.

From what has been said it will be apparent that the direct cause of destructive erosion is, on the one hand, soil disturbance, which destroys the binding forces operating under natural conditions, and on the other hand, the force of running water tending to move it. Removal of natural vegetation also tends to increase the quantity of run-off. The formation of gullies may usually be traced to the creation of a direct fall for run-off concentrated at that point. Gully-cutting must be checked by decreasing the fall and cutting power of the water until it becomes negligible. This may be done by diverting the water to a fresh channel, by providing an artificial channel at the fall, or by raising the level of the gully floor by means of soil-saving dams. This reclamation work should commence at the head of the gully, while the lower part can later be reclaimed by additional dams, if the value of the land warrants the cost.

The general removal of soil over a wide expanse of field (sheet erosion) or shallow gullying of fields is primarily the form of erosion attending any form of cultivation. Cultivation removes the roots which naturally bind the soil together, by turning under the layer of surface organic matter which helps markedly in increasing the absorptive power of the soil, by destroying the soil humus through continuous cropping and exposure, and by making the soil loose and friable. The lastnamed also assists in water absorption, but when water begins to run off it hastens the removal of the soil.

The surest method of preventing erosion is to keep the soil continuously covered with vegetation. For steep slopes and poor rocky soils, forest growth is the best and safest plan. For better soils, capable of producing good yields, permanent grass is recommended for moderate slopes with but intermittent planting of cultivated crops. Fertilization of such pastures will assure more luxuriant growth of grass, and hasten the rate of fertility restoration.

Finally, many soil erosion problems are not individual but community concerns, which can only be tackled and solved through the concerted effort of all concerned. This must usually be achieved through the intervention of an independent authority; this course must inevitably follow the full realisation of the seriousness of soil erosion from the national standpoint.

POINTS ON CHOOSING A TRACTOR.

A tractor is distinctly a business investment, and the man who buys one should be very careful to see that it is of the size, power, and type suitable for the work he requires of it. To assure himself on this important point his best plan is to inspect a range of tractors from which a selection can be made of a unit built for working, large, medium, or small farms, for orchard or vineyard work or for whatever kind of property the purchaser is operating. This is the individual problem that confronts every intending tractor buyer; but he will soon be able to settle it with satisfaction to himself if he examines a full range of modern tractors such as International Harvester provides in the McCormick-Deering tractor line.

Some Important Factors in Cane Irrigation.

H. W. KERR.*

IN the October, 1934, number of the Cane Growers' Quarterly Bulletin (page 25) were reported the results of an irrigation trial conducted at the Bundaberg Experiment Station. A small block of P.O.J. 2878 was March-planted and given weekly irrigation treatments until harvested. In order that plant-food deficiencies might be avoided, monthly applications of fertilizer were also made. Under these conditions it was possible to follow the relationship between atmospheric temperature and crop growth. As reported, the plant cane at eighteen months yielded 93·4 tons per acre, with a c.c.s. of 12·1 per cent.; the monthly growth rate was also presented, and the striking differences between these rates for respective months were emphasised.

The block was ratooned and the first ratoon crop harvested in October, 1935, when the cane was twelve months old. This crop gave 72·8 tons of cane per acre, with a c.c.s. of 13·0 per cent.

It is freely admitted that the conditions under which these crops were produced could not be duplicated on a farm scale, and that no grower would in any case find it profitable to produce crops of this magnitude due to the danger of lodging. It is also true, however, that the average return from irrigated cane in Queensland falls far below the values recorded here, even where the water employed in the growth of the crop is comparable in amount. It is therefore proposed to discuss the growth rates recorded from these trials, and see whether it is possible to relate the factors—water used and crop produced—so as to give us a clue to our problem.

Plate 98 is a graphical representation of the monthly growth rates for the first ratoon crop of the trial. These data were calculated from weekly growth measurements made on a large selection of tagged stalks, and the tonnage of cane produced over a given period was calculated from the elongation recorded during that time in relation to the total length of stalk, which is regarded as proportional to the actual tonnage at harvest time. It is appreciated that allowance should be made for variations in the thickness of stalk; but omission of this consideration will not seriously affect the argument.

Due to the excellent growing conditions which were provided the young ratoons made rapid progress and millable cane was showing early in November. The growth rate slackened towards the end of the month, but then increased to its maximum for the season during the early days of January, to be followed by a well-defined check rising to a second maximum early in February. Thereafter the growth rate declined steadily until the beginning of June, when growth was virtually suspended throughout the ensuing three months, despite an abundance of available plant food and soil moisture.

The actual cane production per month (Plate 99), as calculated from the growth measurement records, was more than 18 tons per acre for both January and February, while for the three summer months—December to February—the total crop growth was 49 tons of cane per acre. As this is in itself an accomplishment of which any cane grower would be proud for a full year's growth, it may be well to investigate the factors involved in this phenomenal performance.

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* In the "Cane Growers' Quarterly" (reprinted by courtesy of Dr. Kerr, Director of the Bureau of Sugar Experiment Stations).

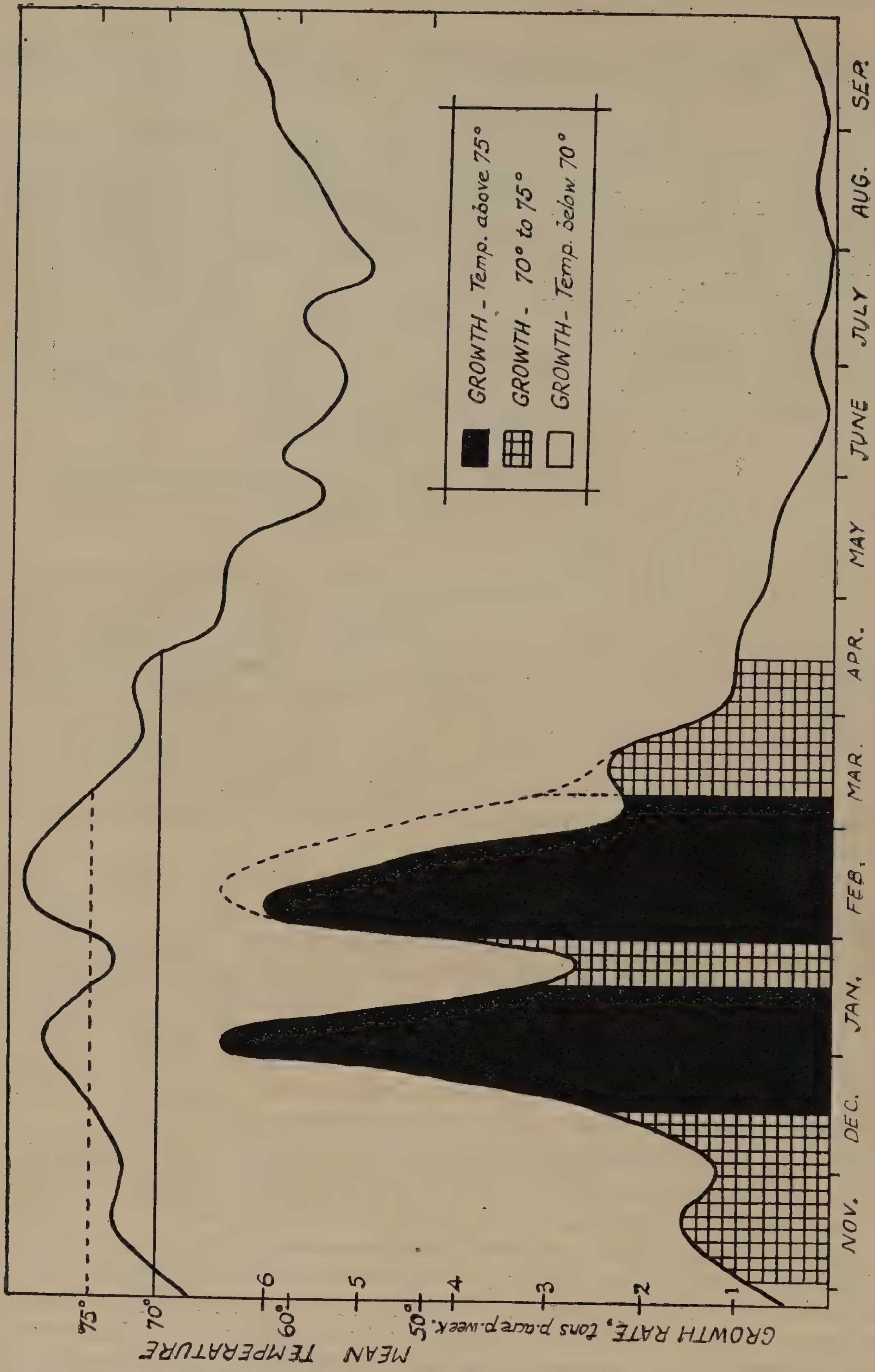

Plate 98.

Graph illustrating the growth rate of a ratoon crop of P.O.J. 2878 at the Bundaberg Experiment Station, 1934-35 season, together with the mean atmospheric temperature curve for the period.

During February trouble was experienced with the irrigation plant, and the dotted portion of the curve suggests the maximum growth rate obtainable.

In Plate 98 is recorded also the mean atmospheric temperature curve. It will be observed that provided soil moisture deficiencies have been eliminated there exists a very close correlation between temperature and growth rate. The following points are clearly demonstrated:—

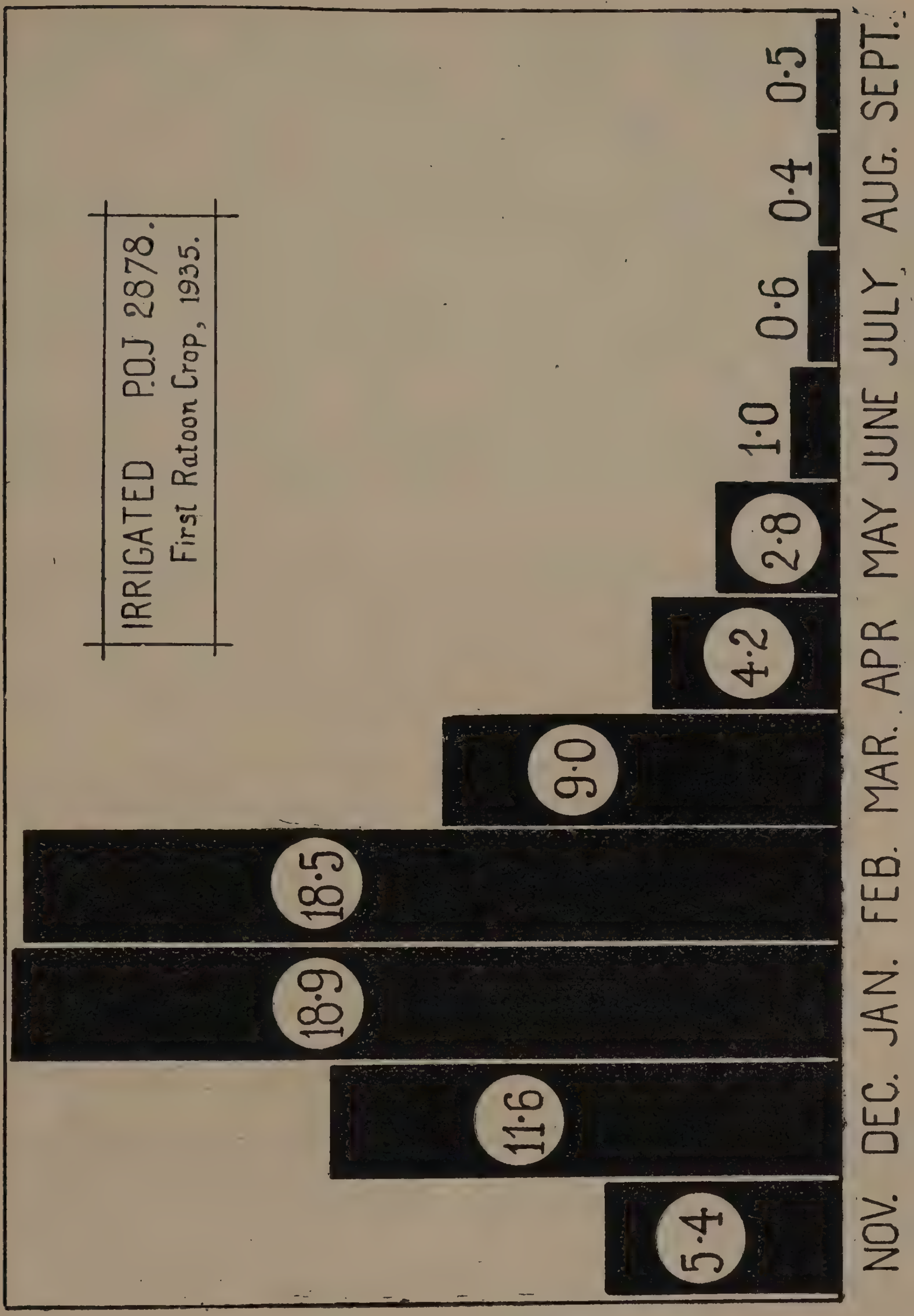

Plate 99.

The blocks represent, by their height, the average monthly growth rates, while the figures in the circles give the actual cane tonnage produced during the month.

(1) Vigorous cane growth commences when the mean temperature rises above 70° F., and declines when it falls below this limit.

(2) Between the limits of mean temperature, 70–75° F., the rate of growth increases at a rapid rate.

(3) When the mean temperature exceeds 75° F., the cane growth rate amounts to more than 6 tons of cane per acre *per week*.

An attempt has been made to bring out these facts more clearly by checking and blocking in those areas of the curve representing the above temperature ranges. It is then observed that the growth check recorded during January was due entirely to a "cool change" in the weather at that time.

The obvious deduction is that for best results from irrigation the farmer must work by the thermometer. So long as the mean daily air temperature lies below 70° F. nothing is gained by excessive watering of the crop; when the seasonal values rise above this figure the cane will make good use of all the soil moisture it can acquire; and when the mean temperature exceeds 75° F. the irrigation plant should be operated day and night for maximum results. In a previous paper on irrigation it was stated that in the production of 1 ton of cane the equivalent of 1¼ to 1½ acre-inches of water are absorbed from the soil by the crop and evaporated from the cane leaves. A growth rate of 6 tons of cane per week, therefore, demands from 7 to 9 acre-inches of water per week. In the absence of adequate rainfall the average pumping plant would be fully taxed to supply this quantity of water even when working continuously. Thus, for a grower watering 40 acres of cane, the daily water consumption would be about 40 acre-inches, or 900,000 gallons; this is practically the average output of a 7-inch centrifugal pump operated day and night.

On the evidence presented it is difficult to over-emphasise this point. No quantity of water applied to the particular crop in question after the month of April could possibly induce vigorous cane growth; for the long, warm days were then past and such water as was supplied merely served to maintain the crop in good condition until harvested. The ideal watering system would then be:—

(*a*) Apply sufficient water to the crop during the spring, autumn, and winter months to avoid any check in growth or any distress due to wilting.

(*b*) During the three summer months it is scarcely possible to over-supply the land with moisture under average farming conditions.

Even when beneficial rains fall watering should be resumed almost immediately; for even under the best of conditions the depth of soil drawn on by the crop roots will not hold more than 5 or 6 acre-inches of available moisture—barely a week's supply during the heat of midsummer.

Such a policy, though doubtless imposing heavy demands on the irrigation plant at this season, would lead in the aggregate to both greater cane tonnages per acre and reduced water consumption.

THE WATER SUPPLY FOR THE DAIRY HERD.

The water supply on many dairy farms is too often a limiting factor in milk production. An abundance of pure, fresh water, is essential for the best results. While not spoken of as a food, it is absolutely necessary for all the processes of nutrition. It is a well-known fact that mastication, digestion, absorption, and assimilation are all impeded by a lack of water. No food can be utilised by the body until it has been brought into solution, and as water is the chief agent in accomplishing this, it will be seen that a good, pure water supply is essential at all times. It is the common carrier of the body, both in the distribution of the nutrients and in the elimination of waste and the various poisonous products through the skin, kidneys, and the digestive tract. Through evaporation from the surface of the body and the lungs it regulates the body temperature. It is, of course, well known that the largest constituent of milk is water, of which it forms about 87 per cent. A shortage of water will cut down a cow's milk flow more quickly than a shortage of feed. The dairyman, in order to maintain a maximum flow of milk, must, in addition to good feeding, provide an ample water supply, as each cow on an average consumes about 12 gallons daily. The quantity consumed depends very largely on the temperature and the milk flow. Cows in milk require three or four times as much water as dry cows. Drinking does not produce milk, but heavy milk production and the heavy eating that results from it induces the consumption of a great quantity of water.—L. VERNEY, Instructor in Dairying.

The Breeding of New Varieties of Sugar-Cane.

ARTHUR F. BELL.*

POSSIBLY no phase of the agriculture of sugar-cane is now receiving as much attention by Experiment Stations as cane breeding, and rightly so. Yield per acre can be improved by various methods, most of which involve the expenditure of considerable sums of money, but once a variety of superior yielding power has been produced it continues to give higher returns per acre with no added outlay.

The cane-breeding programme of the Bureau is now undergoing considerable expansion, and so it was thought that a survey of the aims and methods used might be of some interest at this time. The conditions permitting the expansion of the programme are—

(*a*) The Northern Station has been transferred to Meringa, where the lower rainfall does not interfere so much with the shedding of the pollen of the male parents.

(*b*) The Mackay Station has been transferred to Te Kowai, thus permitting a larger and more representative area to be devoted to seedling raising.

(*c*) A small irrigation plant has been installed at the Bundaberg Station and this will ensure our being certain of raising seedlings under reasonably good conditions in the frequently recurring drought years.

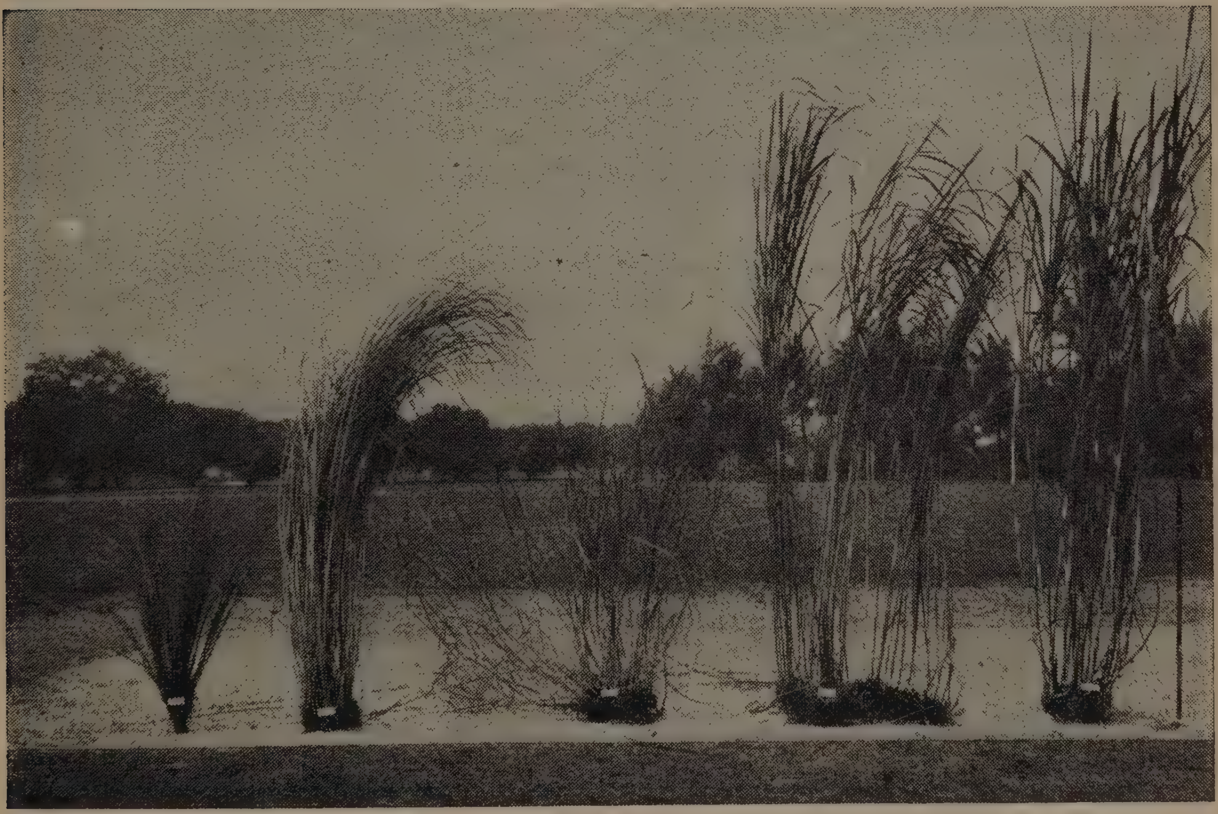

Plate 100.

Showing the diversity in type of ''wild'' canes which may be used as parents in crosses with ''noble'' canes in order to introduce desirable characters in commercial canes. (After Venkatraman.)

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* In the ''Cane Growers' Quarterly,'' and reprinted by courtesy of the Director, Bureau of Sugar Experiment Stations.

It may be emphasised, however, that such irrigation as is used will not be excessive; over-good or over-bad conditions tend to bring the majority of seedlings to the same level and make selection impossible—our aim is to be certain of having reasonably good conditions.

Sugar-cane breeding dates back only to 1889, when seedlings were raised in both Java and the British West Indies, but it is interesting to note that the Queensland Acclimatisation Society was soon in the field and raised a few seedlings in 1890. This work was continued by the Society on a small scale until 1907, when it was abandoned; Q. 813 and Q. 1098 are the best known of the canes produced by this organisation. From 1901-5 seedling raising was carried out by the C.S.R. Company at their Hambledon Plantation, and here were bred the well-known H.Q. 426 (Clark's Seedling) and H.Q. 285. With the establishment of an Experiment Station within the tropics (South Johnstone) this Bureau was enabled to commence seedling raising in 1921, and S.J.4 is the best known of the early seedlings.

During this period most Sugar Experiment Stations had undertaken the breeding of new varieties of sugar-cane, but in general this work had not met with the success which had been anticipated, and the methods employed had not been greatly improved. Within recent years, however, rapid advances have been made, due in part to the better circulation of knowledge through the conferences of the International Society of Sugar Cane Technologists and the discovery of new species of sugar-cane and their value in breeding. In the early period at South Johnstone we were forced to breed only from the "noble" species, with the result that although many vigorous canes of high sugar content were produced, most of them were too "aristocratic" and could not withstand hard conditions or disease. At the present time we have available five species of sugar-cane, one of which was found by the aeroplane expedition led to New Guinea by Dr. E. W. Brandes in 1928. We have been forced, just as all plant and animal breeders are eventually forced, to go back and reintroduce "wild blood" in order to gain stamina.

Recently attempts have been made to cross sugar-cane with plants other than sugar-cane in the hope of building up crossbreeds which will contain some qualities at present lacking in cane. The most promising of these are the sugar-cane sorghum crosses carried out in India by T. S. Venkatraman, who recently visited Queensland as a delegate to the Congress of the International Society of Sugar Cane Technologists. In India, as in parts of Queensland, early maturing canes are a pressing need; it occurred to Mr. Venkatraman that perhaps the crossing of cane with a short cropping plant, such as sorghum, might bring about this result. The attempted crossing was successful and gave progeny which look more like cane than sorghum and reach maturity in five to six months. Unfortunately, they still lack vigour, although the sugar content is reported to be good. It would appear that by back crossing on to cane for one or two generations there is a fair chance that a cane (or should we say a "sorg-cane"?) will be produced having vigour, high sugar content, and early maturity. Four of these first crosses have been introduced into Queensland and will shortly be taken up to Meringa, where it is hoped that they will arrow and enable Mr. Barke to effect crosses back to cane.

The methods employed in raising seedlings vary considerably in detail according to conditions and cost of labour available. In Queensland the general technique is as follows:—Varieties which it is thought desirable to try out as parents are planted in a plot in the Freshwater district, near Cairns, where arrowing is usually heavy. In making any particular cross the arrow of the cane selected as the female parent is left growing in the field; just before the flowers commence to open this arrow is surrounded with several arrows of the variety selected as the male parent. The stalks of the latter are stood in a special solution containing sulphurous and phosphoric acids (see Plate 101); this solution

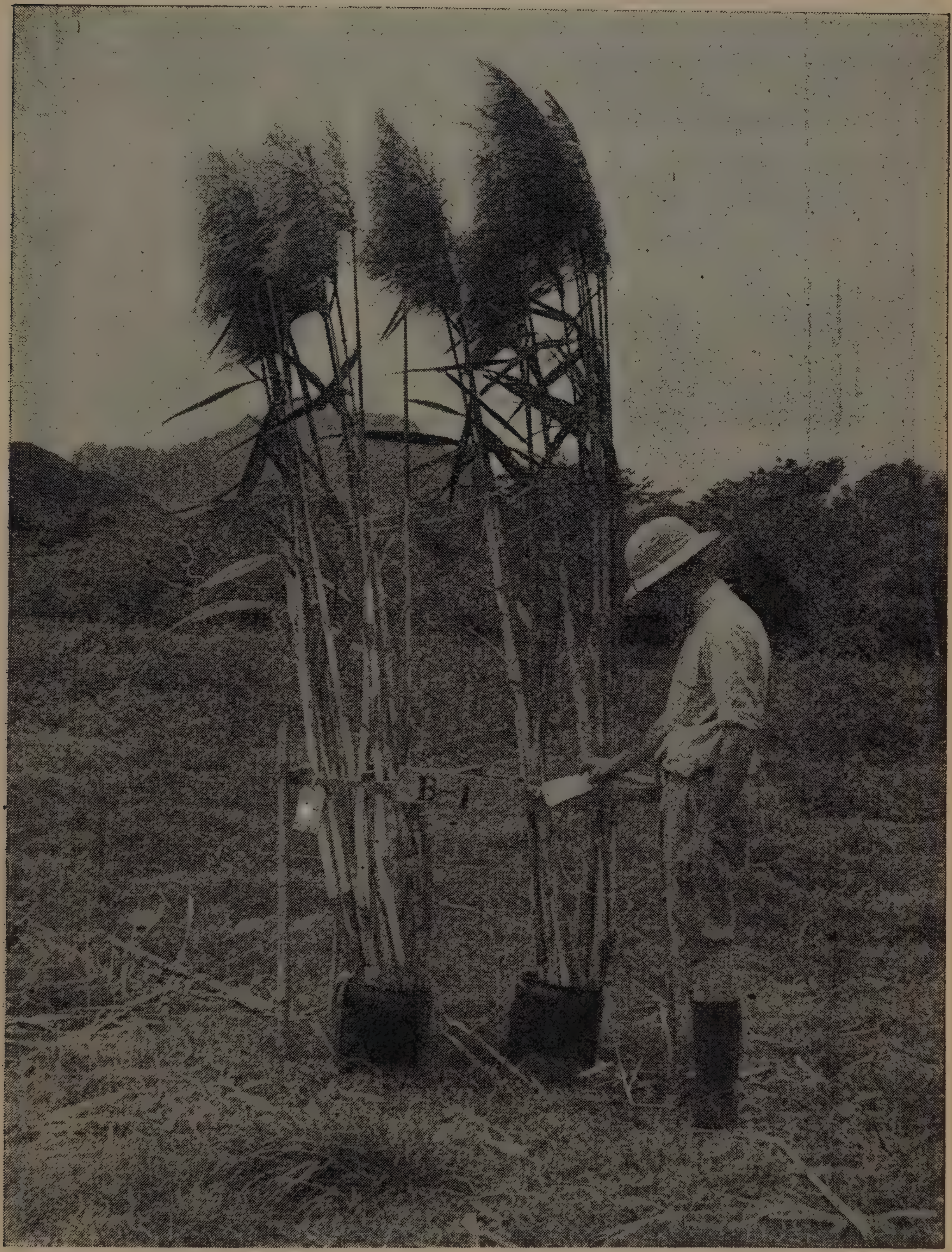

Plate 101.

Arrows of the variety selected as male parents are stood in a special solution and carried to the field, where they are set around the female arrow. (After Mangelsdorf.)

will keep the stalk and arrow alive for weeks, and will allow the normal shedding of the pollen to continue. The canes of the male variety are tapped lightly each morning in order to facilitate the shedding of the pollen.

It is very desirable that the parentage of each seedling should be known with certainty; consequently the variety used as the female parent is chosen because it produces little or no pollen and the male arrows are clustered closely around so as to prevent the deposition of any pollen from other varieties growing nearby. In the case of the older seedlings, such as B. 208 and Q. 813, the seed was just collected in the field, and so only the female parent is known; as a result we are unable to repeat the crosses which produced them.

Plate 102.

Seedlings growing in the germination flat, five weeks old, and ready for potting.

[*Photo. by N. J. King.*

When all the tiny flowers on the female arrow have opened and died off, the male arrows are removed and the female arrow is bagged until the seed has ripened, this ripening usually taking some two or three weeks. The seeds are considerably smaller than a pin's head and are light to dark-brown in colour. They do not keep well and, unless stored under special conditions, must be planted immediately if reasonable results are to be obtained. Seed will not set on the arrows produced by the cane in the Mackay and Bundaberg districts, and so all crossing work is carried out at Freshwater and the "fuzz" is sent to the other stations for germination.

The seed is planted in flat wooden boxes containing a mixture of soil, well-rotted manure or leaf-mould, and sand, only a light covering of soil being applied. The boxes are usually set in glass houses or frames which can be heated during the late winter and early spring months when germination is carried out. The seeds germinate after a few days, and the young seedlings appear very similar to certain young grass seedlings at this stage. They are very delicate, and for some time require constant attention to prevent damage by heat, low humidity, or damping-off fungi.

At the age of about four to five weeks they are transplanted from the flats into pots consisting of a length of galvanised iron piping, about 8 inches long by about 3 inches in diameter (see Plate 104). After about eight weeks' further growth they are transplanted into the field. A hole is dug at the base of a plough furrow and the core of soil, with the roots intact, is tapped out and set in the hole. The seedlings then grow in the field until about August or September, when the selection of the best canes is made.

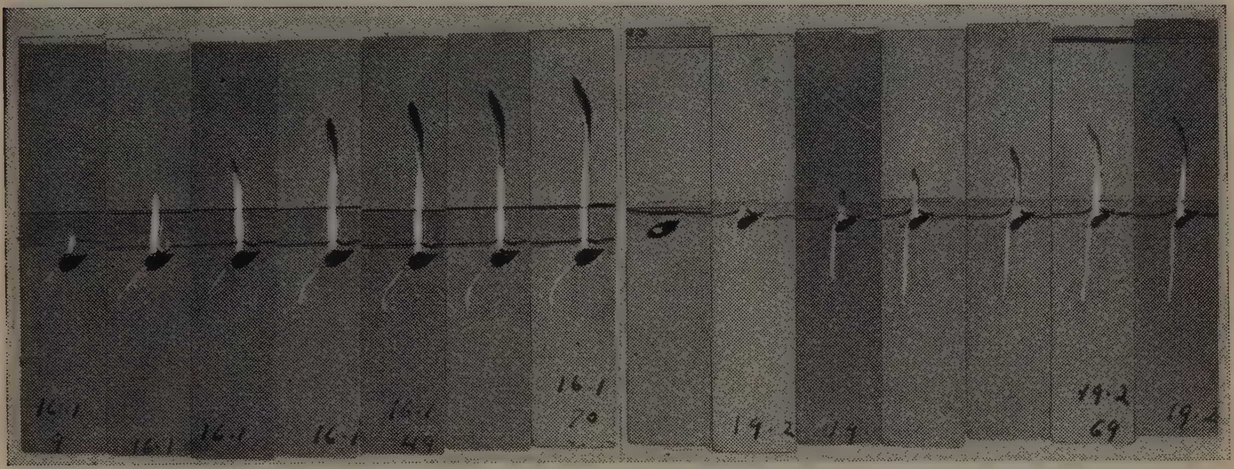

Plate 103.

Photographs taken at daily intervals after the sugar-cane seed has germinated. The seedling on the left had as parents P.O.J. 2878 and P.O.J. 2940, while that on the right was obtained from P.O.J. 2722 and H.Q. 409.

[*Photographs by W. Cottrell-Dormer.*

Plate 104.

Young sugar-cane seedlings growing in galvanised iron tubes; these seedlings are ready for transplanting into the field.

[*"Telegraph," Photo.*

Plate 105.

Seedlings being transplanted from pots to field at the Bundaberg Experiment Station.

[*Photo. by N. J. King.*

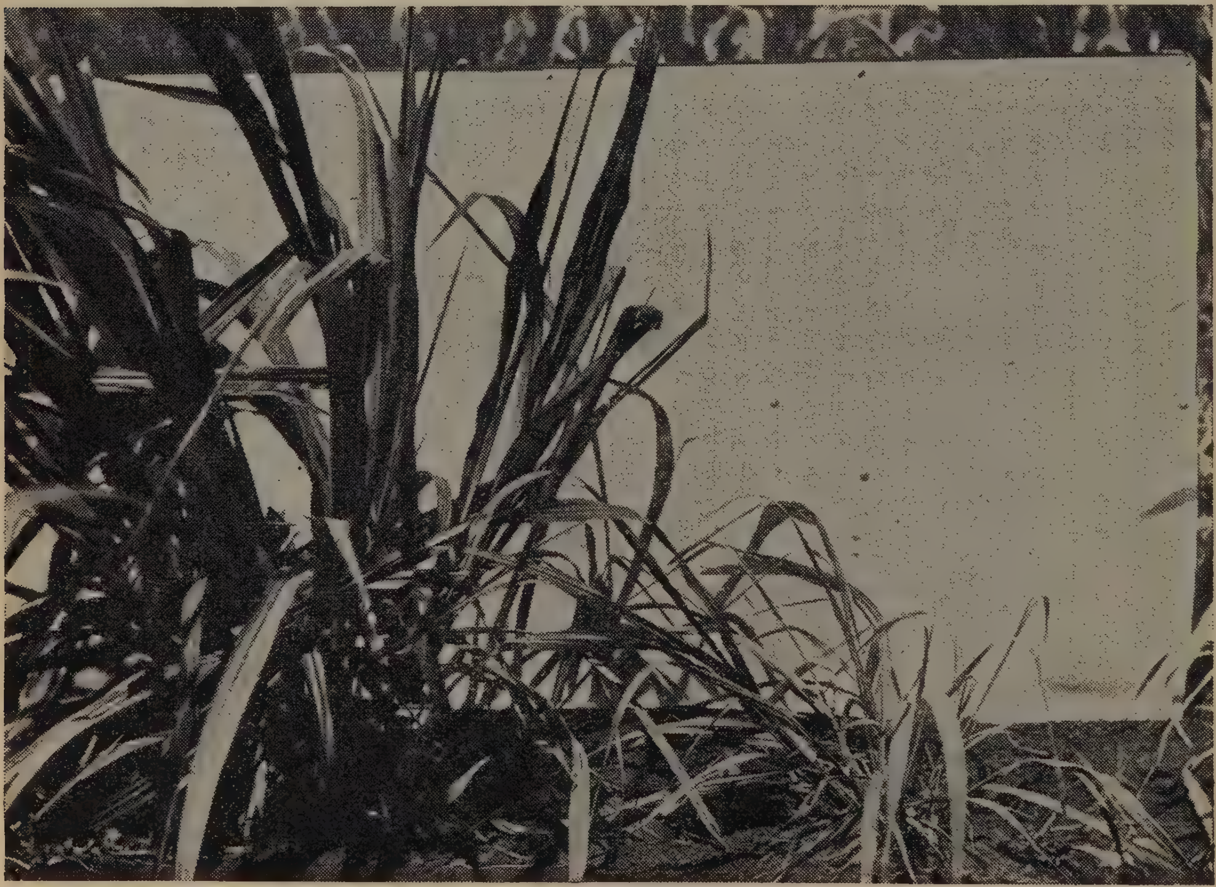

Plate 106.

Photograph illustrating difference in growth in adjacent seedlings of the same cross. Age, five months.

[*Photo. by N. J. King.*

The progeny of any one cross may vary to an extraordinary degree, ranging from fine upstanding stools of 10 to 12 or more stalks per stool, to units which produce practically no cane. Selection is made on the basis of vigour of growth, sugar content, formation of the eyes, type of growth (i.e., whether it is sprawling or not), and so on. As a rule, only about one in a hundred original seedlings is selected for further trial. Thus, if we raise 10,000 seedlings, only about 100 are selected for a second planting, the rest being milled and discarded. It might be thought that such wholesale rejection is rather severe, but there are two points to be borne in mind. Firstly, if we can produce one really good seedling per year which will replace a standard variety, we will be more than satisfied, and if there is only one really good seedling in a batch of 10,000, then it surely should be included in the hundred selected. Secondly, the area of land and facilities available do not permit the handling of large numbers of second and third year seedlings.

Such seedlings as are selected from the original stools are planted out in short rows interspaced with standard varieties and, at maturity, selections are again carried out as in the first year, but naturally with closer attention to detail; about 10 per cent. of these are selected. Third and fourth year tests are carried out on a larger scale, and attention is paid to germination and ratooning qualities, while in the meantime resistance to major diseases has been determined. Finally the 10,000 seedlings are reduced to perhaps two or three which are considered worthy of trial on farms, and these are then set out in comparative trials with standard varieties on different soil types.

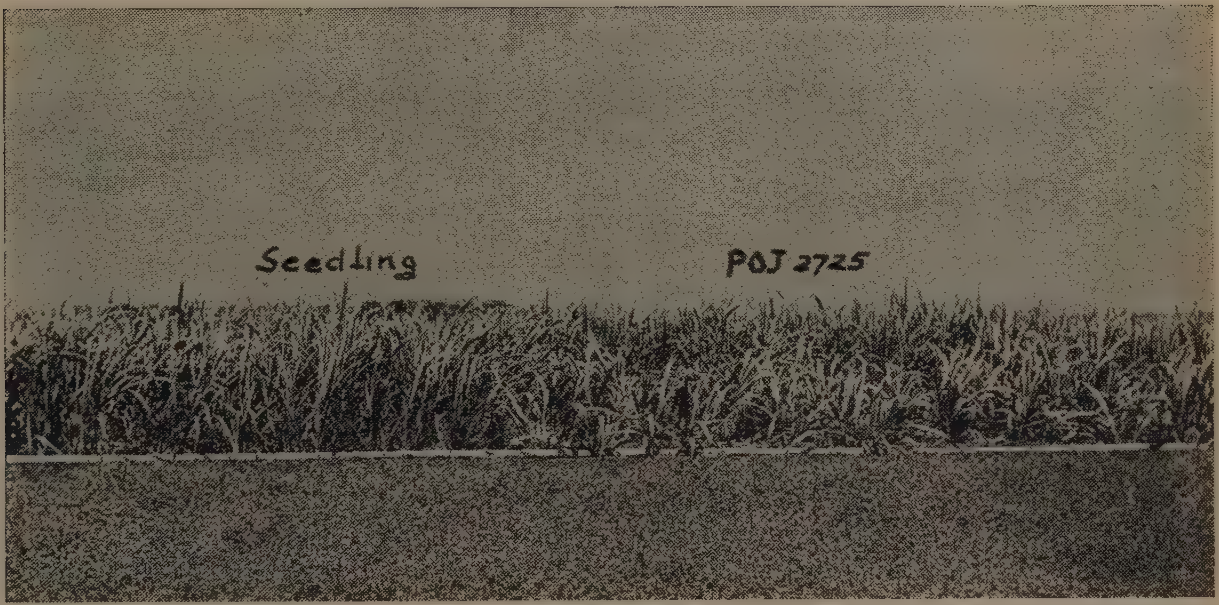

Plate 107.

Comparison of P.O.J. 2725 and a seedling raised and now being tested at the Bundaberg Station. [*Photo. by N. J. King.*

The two outstanding seedlings which have been produced since cane breeding began are P.O.J. 2878 in Java and H. 109 in Hawaii. P.O.J. 2878 was rapidly planted to 98 per cent. of the area, but, unfortunately for the Java planters, they have not reaped the full benefit of this cane owing to drastic reductions in their sugar markets. In Hawaii, even if the Experiment Station had never done anything else of value, its existence would still have been eminently justified, since the cost of its maintenance since its inception has been many times repaid by the extra profit accruing from the planting of H. 109.

The qualities required in a cane breeder are many. He must be a model of patience, painstaking care, and capacity for hard work and long hours. He must be optimistic with an optimism tempered by caution; stout-hearted so that he shall not despair when a promising "world beater" must be discarded on account of disease susceptibility; sympathetic towards and intensely interested in his large family, but ruthless in his destruction of all members who fall short of rigid standards.

On the other hand, the canegrower himself must also be optimistic regarding the final results of a cane-breeding programme. We must ask him to be patient and tolerant also, since it requires time to determine the types of cross and then develop the individuals best suited to the soil, climate, agricultural and disease conditions of each district.

A final word. We are sometimes asked the question, "Why try to breed superior varieties when there is already over-production of sugar?" The answer lies in the reason why farmers till their land before planting and cultivate and fertilize the crop. The function of an Experiment Station, through the efforts of its plant-breeding staff, is to produce superior canes of higher sugar content and thus reduce the unit cost of sugar per acre. The question as to what extent over-production exists and how it shall be controlled is a problem for the economic and not the agricultural advisers of the industry.

Plate 108.

The Road Through the Forest, Tarampa Shire—Lockyer—Darling Downs Highway.

[*Block by Courtesy Main Roads Commission.*

Fiji Disease in South Queensland.

G. A. CHRISTIE.*

FOR many years gumming disease has been responsible for greatly depressed yields in the cane crops of South Queensland, but by substituting disease-resistant canes for the more susceptible varieties the position has been greatly alleviated and losses are rapidly becoming negligible. In order to combat gumming disease it has been necessary to extend the plantings of P.O.J. 2878 and, to a less extent, P.O.J. 2725, two varieties which are susceptible to another important disease—Fiji disease. This disease is more common in the southern districts but is present on a few farms in the Bundaberg-Isis district. The importance of this disease should not be under-estimated, especially in those districts where P.O.J. 2878 holds such promise, and it is in the interest of all canegrowers to assist in its eradication or control.

Plate 109.
Illustrating typical galls on the underside of a diseased leaf.

Fiji disease was first recorded about thirty years ago in the colony from which it takes its name. The industry in these islands was threatened for some years and the crops were seriously affected by the ravages of the disease. It probably originated in New Guinea, and by the interchange of varieties has since spread to Fiji, Australia, and the Philippine Islands.

The earliest symptoms and the outstanding characteristic of the disease is the presence of small yellowish galls which are formed on the under surface of the leaves of diseased cane. These galls may be one to many in number and are usually 1/32 to 1/16 in. in diameter, ranging from $\frac{1}{8}$ in. to 2 in. in length; they are formed by the enlargement of the veins. (See Plate 109.) In the later stages of the disease the leaves become shortened and erect, very stiff and brittle, and take

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* Reprinted from the ''Cane Growers' Quarterly'' by courtesy of Dr. Kerr, Director, Bureau of Sugar Experiment Stations.

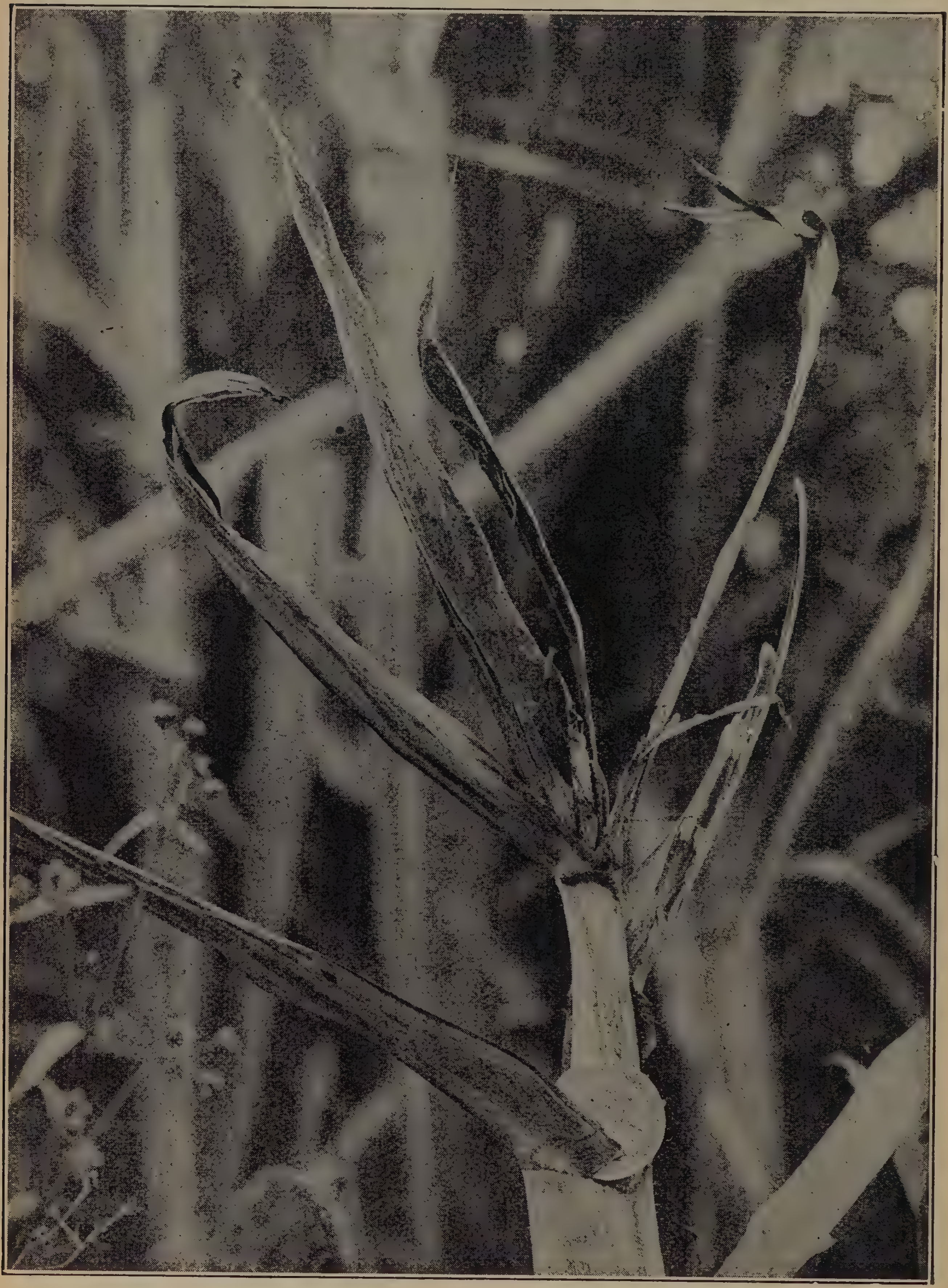

Plate 110.

Illustrating the stiff, stunted, and malformed leaves of a well-advanced stage of secondary infection.

on a darker green colour. In this stage the cane top looks as though it had been eaten by some animal. When such distortion of the top occurs no further growth is made, the leaves become smaller and smaller and eventually the heart dies. (See Plate 110.)

When diseased setts are planted they invariably give rise to diseased stools, which in most cases produce no cane but remain a cluster of stunted grass-like shoots; the ratoon stools from diseased plant stools are also of this type. (See Plate 111.)

Plate 111.

The two small grass-like stools in the foreground are the result of ratooning diseased stools. Variety, P.O.J. 2714.

Fiji disease is permanent, and no authentic cases of recovery from the disease have been observed. It should be stated that the disease bears a resemblance to other minor troubles, particularly to clustered stool, which was described in the "Quarterly Bulletin" for 1st July, 1935 (page 8). The question as to whether Fiji disease is present or not can be settled by the presence or absence of the small leaf galls described above.

The investigation of the manner in which the disease is spread from diseased to healthy cane was successfully undertaken by the Bureau some years ago. Contrary to the belief of many growers, it has been established that no soil infection occurs. After ploughing out and killing diseased cane the soil does not remain infective to cane planted at a later date. Nor does cutting diseased and healthy cane alternately with the same knife produce infection in the healthy cane. The only known means by which Fiji disease is spread is through the feeding activities of the sugar-cane leaf-hopper, a small brownish insect about 1/5 in. in length. After these insects are fed on diseased cane they are capable of infecting any susceptible healthy cane on which they feed. Although cane becomes infected in this way, it does not bear any symptoms for some time after the diseased hoppers have fed on it. Often such diseased cane may appear healthy for some months, and this naturally complicates the job of selecting healthy planting material.

CONTROL.

The methods of control which are recommended, are—

(1) Plant only disease-free cane.

(2) During scarifying and at other times inspect all plant and ratoon cane and dig out any suspicious stools. The leaf-hopper which spreads this disease becomes very scarce during the winter and remains so until about December. Therefore, inspection and digging out of diseased stools should be carried out by November-December.

(3) Restrict ratooning of diseased crops.

(4) The better the conditions for cane growth the better are conditions for the spread of Fiji disease. Therefore, special care is necessary on rich alluvial land or irrigated farms.

(5) Where the disease is well established and spreads rapidly, resistant varieties should be planted. The choice of variety will depend, of course, on what other diseases are present; the best known resistant varieties are P.O.J. 213, P.O.J. 234, Co. 290, Q. 813, H.Q. 285, and Mahona; Korpi and Oramboo are also satisfactorily resistant, while P.O.J. 2379 shows promise in this respect.

DISTRIBUTION OF THE DISEASE.

During this and the previous season a considerable amount of field survey work has been carried out by Bureau officers, and the results are briefly set out below:—

Bundaberg.

Continued field inspections and digging out of diseased stools, together with supervised plant selection, has reduced the disease considerably at Bingera, though infection is still present and the situation requires close attention. In the Kalkie quarantine area, disease surveys have revealed a reduction in the number of infected farms and in the degree of infection. Nevertheless, the disease is by no means under control on some of the river-flat farms, and some more rigid form of control may become necessary.

Isis.

The disease was reported on several farms some years ago, but with the co-operation of growers and mill officers it was speedily brought under control. Recently it has been found on two neighbouring farms, one of which had carried the disease previously. Owing to the extensive plantings of the very susceptible variety P.O.J. 2878 the present outbreak must be regarded more seriously than the previous one.

Maryborough.

A considerable amount of inspectional work has been done in this district, and since February last year some 350 farms have been inspected at least once. In the Maryborough district proper the disease is present to a considerable degree, and the use of resistant varieties should be more widely adopted. In the Yerra-Antigua section the disease was found on 27 farms in a total of 127 inspected, while 7 in a total of 92 inspected were infected in the Pialba-Takura section. In both cases, however, the infection amounted to only a few stools per farm, and hence the situation should be readily controlled by the application of a little care on the part of the farmers concerned. At Mount Bauple 2 infected farms were found in the 72 inspected, so that the situation in that locality could readily be controlled.

Moreton.

A survey of a portion of the area showed that Fiji disease was present on 11 farms in 88 inspected. These farms included all that might be suspected of having the disease, and therefore the situation is better than appears at first sight, although definitely serious in view of the value of P.O.J. 2878 in this district. With one exception the disease amounted to a very few stools per farm.

HOW FREQUENTLY DO GIANT TOADS PRODUCE EGGS?

We have been asked repeatedly whether the toads lay but once in a year or whether they can produce eggs at more frequent intervals. In order to try and find an answer to this question numbered arm bands were placed on females which were definitely observed depositing eggs. Now, for the first time, we have a record of one of these banded females laying again. No. 1, which produced 16,000 eggs on 17th March last, was captured in the act of laying a further large batch on 30th May. Unfortunately, her egg strings were intertwined with those of eight other toads which laid on the same day, so it was impossible to determine accurately the number which this individual laid. The total number produced by the nine females on this morning was 125,000.

At least 52 toads have laid at Meringa since the 17th November, 1935, and as we have only 37 females in all, several have laid more than once.

It is of interest to record that not less than 1,560,000 eggs have been laid to date, and approximately 62,000 toadlets have been caught and distributed. Male toads are to be heard calling almost nightly in Tully and in parts of the Gordonvale area.

J.H.B., in the "Cane Growers' Quarterly."

Subterranean Waters of the Woongarra Lands.

THEIR SUITABILITY FOR IRRIGATION.

N. J. KING.*

THE past four or five years have seen in Bundaberg the advancement of irrigation from an experiment to an outstanding commercial example of crop control. The large Bingera and Fairymead Plantations, with two basically different schemes of water production, have shown that successful irrigation of cane is just as practicable in the sub-tropical south as in the Burdekin delta. The refusal of the Bundaberg farmers (in the proposed benefited area) to be burdened with a community irrigation undertaking has left the onus on the irrigation-mined grower of developing an individual plant for his farm requirements. In the immediate Bundaberg district this involves the search for underground water, as very few farms have access to river water of the necessary purity.

A number of growers have already investigated the subterranean supplies on the forest lands of South Kalkie, Clayton, and Gooburrum; and in most of the cases which have come under the writer's notice, success has rewarded their efforts. The few cases where difficulty has been encountered have probably been due to unsuitable spears or failure to lodge the spears in the proper drift, but in no case has the water been unsatisfactory. It is the purpose of this article, however, to discuss the subterranean supplies of the Woongarra lands, as here the problem is a particular one, and one about which divided opinions are held by local growers. Space will not be taken up by discussing the suitability of the red volcanic soils for irrigation. This has been definitely proved, if proof were needed, by the few plantations and farms on which irrigation plants have already been installed. Rather is it proposed to show the suitability of most of our waters for irrigation.

As far back as 1905 Dr. Maxwell, then Director of Sugar Experiment Stations, carried out a water survey of the Woongarra area with a similar object in view. His report of 1906 contains some valuable and surprising figures in the light of the fact that the general current opinion regarding the underground water supplies is that they are not fitted for irrigation purposes. Tabulated in his report are the following figures:—

No. of Waters.	Total Solids, Grains per Gallon.	Salt, Grains per Gallon.
	From—	From—
6	1 to 10	2 to 6
52	11 to 20	3 to 14
46	21 to 30	3 to 28
17	31 to 40	9 to 32
11	41 to 50	14 to 28
8	51 to 60	22 to 40
2	61 to 70	24 to 32
9	71 to 80	29 to 51
3	81 to 90	33 to 43
8	91 to 100	43 to 61
20	101 to 150	40 to 85
4	151 to 200	86 to 120
2	201 to 250	107 to 133
1	251 to 300	145
1	301 to 350	194
1	351 to 400	229
1	401 to 450	242
1	550 to 600	462
1	650 to 700	427

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* Reprinted from the "Cane Growers' Quarterly" by courtesy of Dr. Kerr, Director, Bureau of Sugar Experiment Stations.

From the above 194 samples from wells on the Woongarra, 182 are considered suitable for irrigation *on the Woongarra soils.* Reasons are given below for this belief. It must be remembered that in 1905 the quality of these waters was probably as low as it had ever been, as four droughts had been experienced in the previous five years. Unfortunately we cannot accept the above tabulated figures on their face value. These wells, probably sunk for domestic or stock purposes, were in many cases shallow wells tapping only surface water. Similarly one cannot be certain that, if subjected to severe pumping test, the quality of the water would not change, becoming more or less saline. Another objection is that unless tested with a pump over a fair period, no idea of the amount of water available for irrigation could be obtained.

In 1933 the writer was instructed to carry out a similar survey of the then existing wells. A considerable amount of work resulted in a similar unsatisfactory position. From farm to neighbouring farm well waters varied from excellent to very saline, but in most cases, as above, the wells were sunk purely for domestic supplies, and not with a view to large water output. Consequently most wells were shallow—less than 50 feet—and the greatest pumping strain exerted was that of a windmill. No conclusive data can be obtained from the analysis of such samples. A shallow well may give excellent quality water, but a poor supply. The deepening of such a well to increase the output has resulted on occasion in tapping a deeper supply of lower quality. Experience of the necessity for carrying out a pumping test before installing a pumping plant was gained on the Experiment Station in 1934. The well on the Experiment Station has long been known for the excellence of the water quality—3 grains of salt per gallon—and its ability to stand up to continued pumping during droughts. For many years a windmill was the sole test of the well. Some years ago an engine and pump-jack were installed, pumping approximately 900 gallons per hour, and in 1934 this was replaced by a small centrifugal pump delivering 2,000 gallons per hour. Neither of these small pumps made any appreciable impression on the water level in the well. As the well is only some 42 feet deep the performance was considered a good one. In 1934 we investigated the possibilities of irrigation, and a 3-inch pump was installed temporarily on the well. It succeeded in emptying the well containing its usual 20 feet of water in approximately half an-hour. It could be calculated from the speed of drop of the water, and the rapidity of filling after stopping the pump that the limit of the well would be some four to five thousand gallons per hour.

The above and other cases which have been investigated exemplify the impossibility of calculating the water capacity of a well without actual pumping data. In the above case a bore was put down at the bottom of the well to a total depth of 170 feet without encountering a water-bearing stratum. On another site on the station a bore was sunk to 140 feet, and the only water found was a surface supply between 15 and 45 feet. With four of these bores we were able to obtain a supply approximating to 9,000 gallons per hour. This one instance is sufficient to show that underground water in large amounts cannot be obtained everywhere on the Woongarra. A popular statement is that water can be obtained anywhere if one goes deeply enough for it. Possibly true, but the problem and cost of lifting it must be considered.

It was mentioned above that 182 of the samples of water obtained were suitable for irrigation *on the Woongarra lands.* By this is meant that although suitable here the same waters may not be harmless on sandier soil types. Due to recent developments in soil science and greater knowledge now current on soils and irrigation, waters considered unsuitable for irrigation twenty years ago are now frequently recommended. Not only the water but the soil type must be considered in interpreting water analyses.

During 1933 the well water at Qunaba was investigated insofar as its effect on the Qunaba volcanic soils was concerned. It was desired to find out whether ill effects were likely to accrue from using a water containing 121 grains of total solids, with 89 grains of salt per gallon, on the Qunaba soils. It was already manifest that the water would produce an excellent crop, but the effects of the continued use of it over a number of years were problematical. A detailed analysis of the water was as follows:—

	Grains per gallon.
Chlorides (calculated as common salt)	88·8
Total hardness (calculated as lime carbonate) ..	49·7
Total solids	121·6
Detailed analysis:—	
Chloride	53
Bicarbonate	18
Sulphate	12
Silica	3
Calcium (lime)	6
Magnesium	9
Sodium	20
Potassium	0·35
Total	121·35

It will be observed that the concentration of magnesium salts exceeds that of the lime salts. There was the remote possibility that a concentration of magnesium in the soil may prove detrimental to plant growth. The following test was applied:—A two-foot column of the soil was taken and subjected in the laboratory to leaching with Qunaba water—the equivalent of 20 acre-inches of water being used. This would be comparable with 4 five-inch irrigations. A similar column of soil obtained at the same time was not treated with the water. Both of these samples were taken after irrigation had been carried out with the Qunaba water for five months. Later, after the April, 1933, rains, which aggregated some eight inches, a further sample was taken from the same site to observe the effect of rain in washing out any accumulated salts. The fourth soil sample was taken from a non-cultivated adjacent area which received no irrigation water.

Soil.	pH (MEASURE OF ACIDITY).		AVAILABLE BASES AS M.E. PER 100 GMS.				Available Phosphate p.p.m.	Lime Carbonate %	Chlorine %
	In Water.	In KCl Soln.	Ca (Lime).	Mg (Magnesia).	K (Potash).	Na (Soda).			
No. 1 soil irrigated for 5 months and sampled following a 5″ application	8·27	7·74	32·9	13·1	·43	1·05	481	·32	·03
No. 2 identical with No. 1 but leached in laboratory with further 20″ of water	8·30	7·76	33·3	12·5	·35	1·20	540	·24	·03
No. 3. As No. 1 but sampled after April rains	8·19	7·56	20·8	10·5	·35	1·20	206	·21	·02
No. 4. Non irrigated soil	8·20	7·36	13·8	5·9	·16	·59	169	·03	·006

There is no evidence here of serious accumulation of salt. There is a slight increase in sodium, but so slight as to be almost insignificant. On the figures obtained there appears to be no reason why this water should not be used for crop production on these soils.

It must not be assumed, however, that similar remarks apply to other soil types. On the general run of the Bundaberg forest lands, the subterranean water is of good quality—less than 10 grains of salt per gallon—but it sometimes occurs, on farms near tidal rivers, that the underground water is more saline. In any case outside the red volcanic soils, where only average quality water is procurable, advice should be obtained before continued use for irrigation is practised.

The statement that water unsuitable for washing (that is, which will not lather freely with soap) is unfitted for irrigation is quite incorrect. Many waters contain lime in solution and these certainly could not be used for washing; yet the lime would have a beneficial rather than a deleterious effect on most soils.

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"Humus"—What is It?

N. J. KING.*

THROUGHOUT the literature of agriculture from all parts of the world the word "humus" is conspicuous. In seeking a definition we find that "humus" is described as "the somewhat indefinite nitrogenous and carbonaceous material resulting from the decay of plants." When plant remains are added to the soil some of the constituents tend to undergo rapid decomposition. This decomposition is the result of the microscopic population of the soil, which utilizes the material as food. The speed of the decomposition depends on the nature of the plant residues and on the type of soil. Other factors such as temperature and moisture greatly influence the rotting-down of the material also.

The partially decomposed material forms a vague and indefinite group of substances to which has been given the name "humus." It has important physical effects on the soil and possesses a number of properties not usually shown by undecomposed plant residues.

Firstly it causes the soil to become "puffed up," and so leads to an increase in the pore space in the soil. This results in a marked improvement in tilth and general physical condition; secondly, it increases the moisture-holding capacity of the soil, since humus has an enormous capacity for absorbing water as compared with the soil minerals; thirdly, although humus is essentially transitional, it has a certain degree of permanency and only slowly disappears from the soil. It disappears more rapidly in tropical than in temperate regions, and more quickly in sandy soils than in loams and clays; finally, humus is rich in nitrogen, which is now universally acknowledged by farmers as an essential factor in cane growth.

In certain European countries where intensive farming is necessary, the utilization of farmyard manure is the general rule, but the production of soil humus by this means on cane farms could not, for obvious reasons, be considered. The canegrower, therefore, grows green crops to be ploughed in, and in some cases utilizes plant residues in the form of cane trash in an attempt to improve his soil. The value of these practices may be considered as follows:—

It will be readily admitted that an improvement in soil tilth is always desirable, and that an increase in moisture-holding capacity would be welcomed on all except the badly-drained farms. Likewise a supply of nitrogen per medium of humus would constitute a saving in fertilizer outlay. If these three objects can be gained by increasing the humus content of the soil, then the end justifies the means employed. In the growing of a green manure crop (Poona pea, Mauritius bean, cowpea, &c.) advantage is taken of the fact that these crops belong to a certain class of plants known as legumes. Legumes have the property of being able to assimilate nitrogen from the atmosphere through the co-operation of bacteria which make their home in the nodules on the plant roots. It is recognised, therefore, that such plants when ploughed in are enriching the soil with so much nitrogen which they have taken from the air. This property is not possessed by sugar-cane, maize, sorghum, and other plants, which return to the soil only such nitrogen as they have taken from it.

A good crop of Poona pea will produce 15 tons of green matter to the acre, and the ploughing in of this mass of material must, when rotted, undoubtedly improve the mechanical condition of the soil. The amount of nitrogen thus added to the soil would be equivalent to approximately 700 lb. of sulphate of ammonia to the acre. The ploughing in of a 15-ton crop of maize would apparently have the same effect on the soil tilth, but other factors operate against it. The prime requirement for rapid and complete decomposition of a green crop—apart from temperature and moisture—is a good nitrogen supply. Decomposition proceeds by means of bacteria and fungi, and a balanced food supply of nitrogen and carbonaceous material is essential for the working of these microscopic labourers. In the case of Poona pea and other legumes the balanced ration is present, but with other crops or a body of trash the nitrogen supply is too low, and the rate of decomposition is retarded. There are two methods of speeding up the rotting of trash—(1) To sow a green manure crop (such as Poona pea) as soon as the trash is ploughed in. This, when ploughed in, in turn, will supply the nitrogen for the rotting of the trash as well as itself; (2) to broadcast sulphate of ammonia on the trash before ploughing in, and thus ensure the necessary food for the bacteria. The method adopted will, of course, be decided by the particular farm or plantation practice.

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* Reprinted from the "Cane Growers' Quarterly" by courtesy of the Director, Bureau of Sugar Experiment Stations.

No doubt many farmers have seen the result of ploughing in trash with no subsequent attempt to supply nitrogen to the soil for decomposition. The writer has observed cases where trash has remained unrotted for twelve months after turning in, only because no green crop was grown, to be ploughed under and assist in the process.

The effect on numbers of soil micro-organisms of ploughing in plant residues is shown by the following figures. Recently one of the Bureau pathologists carried out an investigation on a block on the Bundaberg Experiment Station which is being used as a trash experiment. One portion of the block has been farmed according to standard practice, while the other portion has had all trash ploughed in since 1932. The decomposition of the 1935 trash and the subsequent Poona pea crop were practically complete when the counts were made.

—	Bacteria and Actinomyces.	Fungi.
Trash Plot	108,120,000	2,400,000
No Trash Plot	14,530,000	550,000

These figures are per gram of soil.

It should always be kept in mind that humus affords energy to numerous micro-organisms, and is gradually converted by them into simple substances appropriate for plant nutrition. We may look upon its constituents as taking part in a perpetual cycle—in one stage nourishing the growing plant and storing up the energy of sunlight; in the other stage nourishing micro-organisms and liberating energy and plant foods.

Sometimes humus is lost, sometimes worn out, and at other times destroyed. Rains and floods will often wash humus away from hillsides. Micro-organisms will use it up in the process of making soluble compounds, and it is destroyed by oxidation and by fires. Any intensive method of cultivation increases oxidation, thereby reducing the humus content unless provision is made to replenish the supply by ploughing in more green crops or trash.

Temperature is a very important factor in humus formation and destruction. Humus will be formed wherever conditions of temperature and moisture allow the growth of crops and the survival of micro-organisms in the soil; and humus will be destroyed by micro-organisms under exactly the same conditions. But as the destruction of organic matter is relatively proportional to the temperature we find that two zones can be classified—(1) In which humus will accumulate: here the conditions are more favourable to formation than to destruction, and the temperatures vary between zero and 77 degrees F.; (2) in which humus is destroyed more rapidly than it is formed (assuming that adequate air and moisture are available). This occurs at temperatures above 77 degrees F. This is shown diagrammatically in Plate 112. Here the base line records temperature, and the perpendicular line represents humus formation or loss. The curved line A represents humus formation at different temperatures, and the line B shows humus destruction. The shaded area is therefore the zone of humus accumulation, wherein humus is formed more rapidly than it is destroyed.

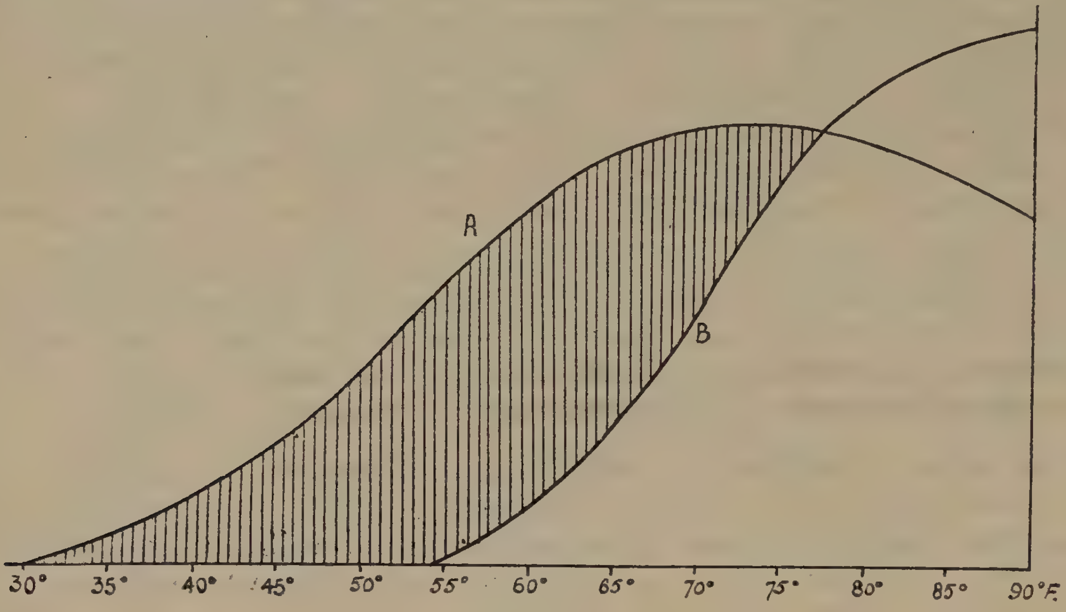
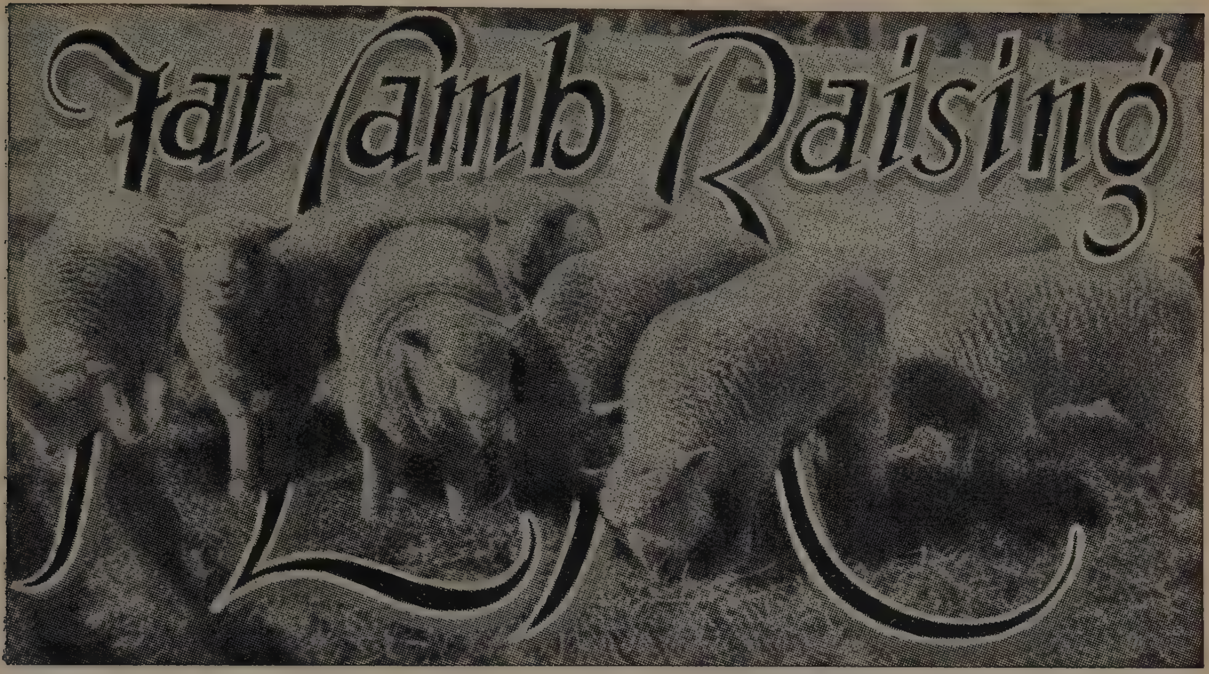


Plate 112.

Curves showing the relationship between temperature and (A) rate of humus accumulation, and (B) rate of humus decomposition. It will be noted that temperatures experienced in the Queensland cane areas lie on those portions of the curve where rates of decomposition are high.

The following question is often asked by farmers on the red volcanic soils. Since we already have good tilth, and can supply nitrogen conveniently from a bag of sulphate of ammonia, why go to all this trouble to provide humus? Apart from the argument of increasing the moisture-holding cacapity of the soil, the following convincing reason may be given:—Recent work in the Brisbane laboratories of the Bureau has shown that the addition of trash to three of Queensland's major cane-producing soil types has resulted after twelve months decomposition in large increases in the amounts of available plant foods in the soil. The process of decomposition of organic matter has evidently a weathering effect on the soil particles, thus transforming insoluble compounds into an available form. An extremely important feature of this same work is that the trash treatment of the soil decreased the soil acidity, thus disproving the popular theory that organic matter would make the soil more acid.



Sheep-breeding.

JAS. CAREW, Senior Instructor in Sheep and Wool.

SHEEP-BREEDING in Queensland is confined almost entirely to the Merino for the purpose of producing wool. The enormous area of country over which sheep are run embraces such a wide range of conditions, soil, and climate, which influence the growth and variety of grasses, shrubs, herbage, and edible trees, that it can be fully appreciated that all Queensland sheep country is not suitable for sheep-breeding, apart, of course, from ordinary flock maintenance and increase. Many breeders scattered over an area extending from the New South Wales border to the north-western portion of Queensland are, however, now breeding good quality flock rams, both for their own use and for sale, while some of these breeders are coming into prominence through their establishment of special stud flocks. Large numbers of rams are introduced from New South Wales chiefly, and their influence in improving the type here is well known and appreciated.

This improvement, together with the influence exercised by local success on the minds of sheep breeders, has inspired a confidence which is resulting in a tendency to improve the type and standard of present flocks. The introduction of high-quality stock is always an advantage if they are of the proper type and suitable to the conditions under which they are to live. It is not the introduction of fresh blood that counts for improvement, unless it is of the correct strain and type which possesses the power of prepotency, that is, the power possessed by some animals of stamping their characteristics on their progeny. When a sire of high quality of the desired type is found to possess this power of dominance or prepotency his value should be fully appreciated. It is only the keen and attentive sheep breeder who detects the desired quality in young sheep who will be able to trace these special features to the sire. When commencing on flock improvement the ideal should be pictured in the mind's eye. Obtain a sire of the desired type, and select ewes that should be suitable. If the progeny are true to type, see that the standard is maintained by breeding on correct lines. In order that the pedigree of prominent strains may be watched, flock

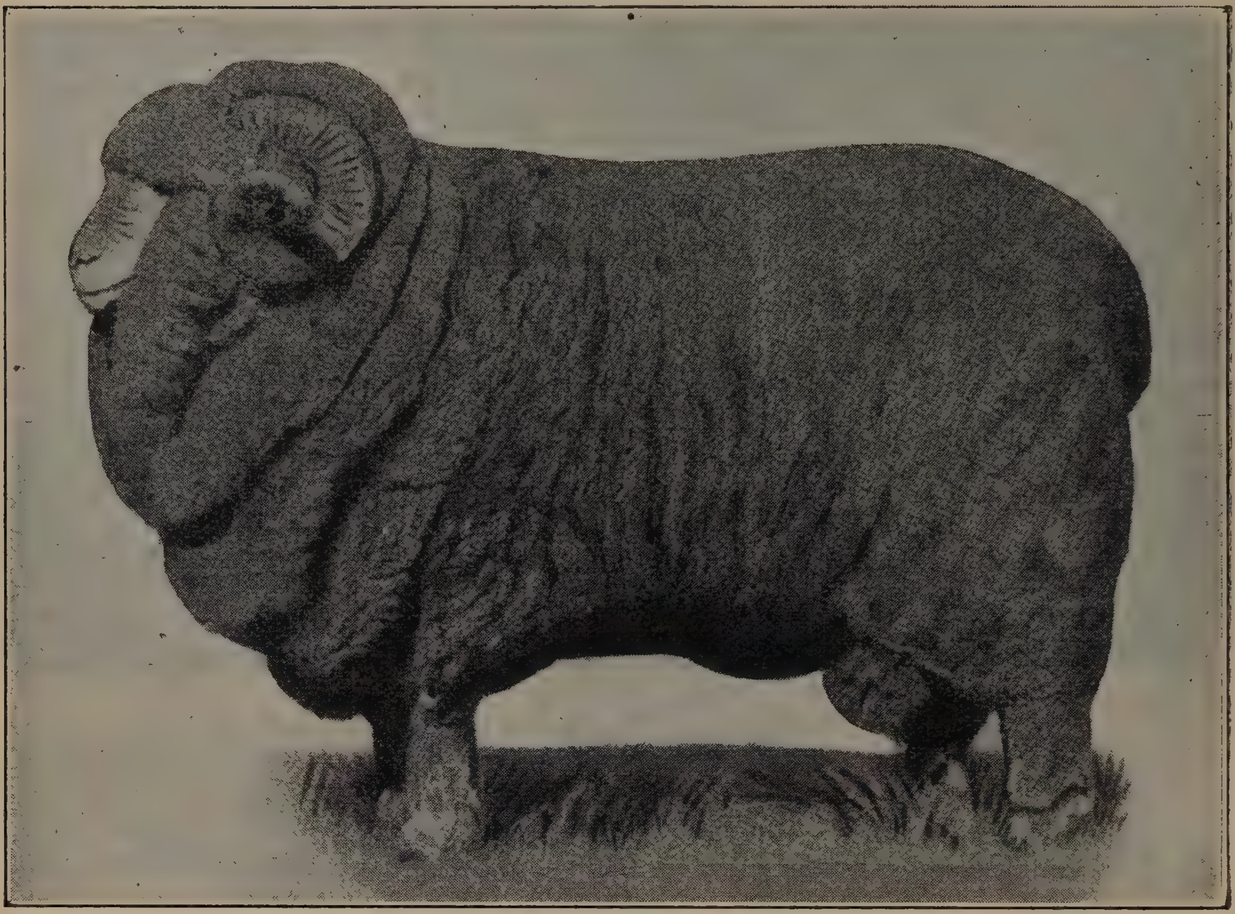


Plate 113.
A Good Type of present-day Australian Merino Ram.

books are necessary. Feeding, local conditions, and environment have also an important influence on successful sheep-breeding.

In Queensland the normally dry late autumn, winter, and early spring, with the consequential shortage of suitable green feed is a serious handicap in some districts. A supplementary ration, rich in protein, will be a decided advantage in times of hard, dry feed and scarcity.

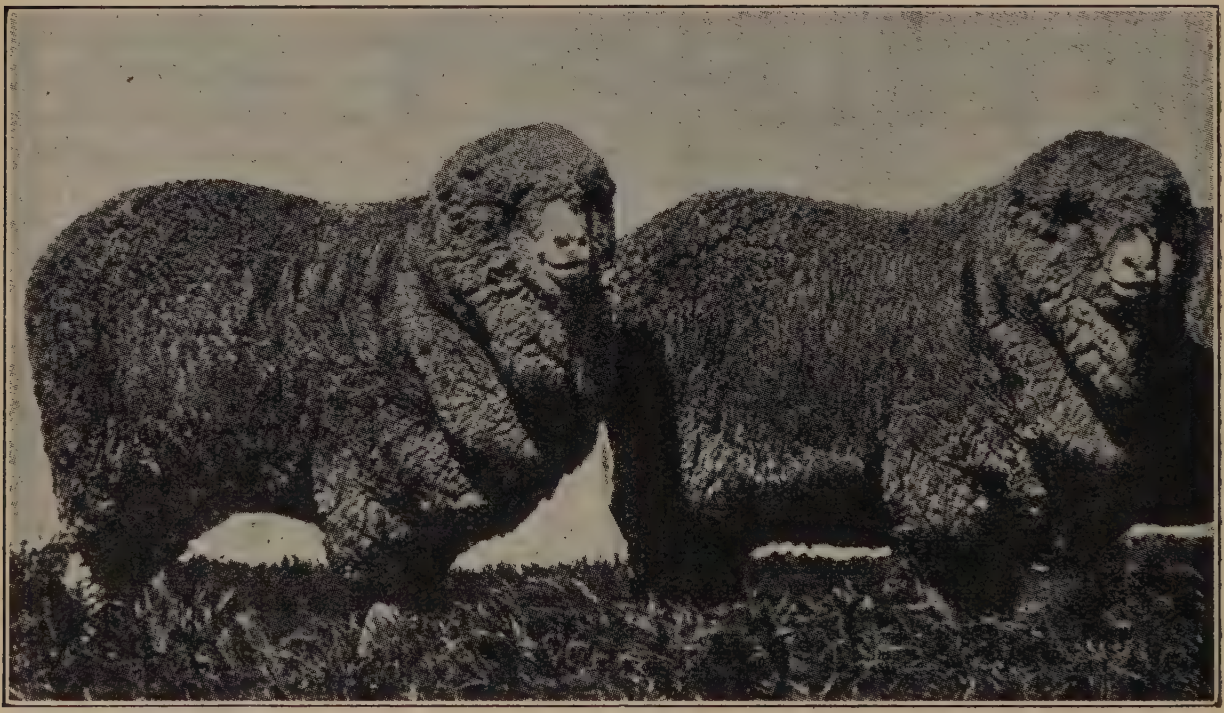


Plate 114.
Merino Ewes.

The Dairy Farm

A Pasture Improvement Programme.

C. W. WINDERS, B.Sc.Agr., Assistant Agrostologist.

DURING the period of conversion of holdings from the virgin state into grazing farms, pioneering conditions necessarily prevail, and settlers with limited capital are obliged to direct their energies to the most urgent requirements, such as clearing and sowing grasses that become established quickly. Most districts have now passed out of the pioneering stage, however, and landholders in such districts are wisely devoting more attention to pasture management and pasture improvement.

There are three distinct angles from which the problem of producing better pasturage may be approached, namely:—

(1) Better use of existing pastures;
(2) Improvement of existing pastures by renovation and topdressing;
(3) Laying down of superior pasture mixtures.

In order that the best possible use may be made of the better-class grazing areas on any farm, it is essential that the pastures be divided into fairly small paddocks. Every farmer knows how the production of his herd rises when the fresh bite is substituted for rank-growing grass. By having a number of small paddocks which can be grazed in rotation the dairy farmer is assured, at all times during the growing season, of having fresh young grass available for his stock. So important is subdivision, that the erection of fences is recommended as the first step in pasture improvement.

Renovation and topdressing of existing pastures, particularly of old stands, offer other means of increasing production of pastures which are not yielding as heavily as they should. Renovation by means of ploughing or drastic harrowing with special implements corrects the sodbound condition of the grasses and improves the soil conditions. The net result is a fresh lease of life for the pasture. In situations where crops can be grown, a more effective means of maintaining high producing pastures than periodical renovation is to treat pasture as a unit in a crop rotation, allowing one or two seasons for crops between four-five year stands of pasture.

Although adverse weather very often prevents the full benefit of fertilizer applications from being realised, many dairy farmers and graziers have used pasture fertilizers with encouraging results. Most of our coastal grazing country is deficient in lime, and applications of 1 ton and upwards of agricultural lime per acre have produced a marked improvement in the pasture. Superphosphate and sulphate of ammonia are the two fertilizers used most commonly for pasture topdressing. Usually, it is necessary to renovate a pasture by mechanical treatment before efficient topdressing can be carried out.

On a great number of properties the best of the proven general purpose grasses are well established, but each has its limitations and information is every day being sought regarding pastures for special purposes or for special situations. There is an increasing demand for advice concerning winter pastures. Numerous grasses and clovers have been proved to be useful for winter grazing purposes, and recommendations for various districts are obtainable from the Department of Agriculture and Stock, Brisbane. Farmers desirous of sowing winter pastures for the 1937 season are advised to seek advice at an early date, in order that they may proceed with the preparation of land for sowing.

QUEENSLAND SHOW DATES FOR 1937.

April.

Oakey	7th and 8th
Toowoomba Royal	12th to 15th
Dalby	21st and 22nd

May.

Longreach	3rd to 6th
Beaudesert—	
Show	5th and 6th
Bushmen's Carnival	7th and 8th
Wallumbilla	6th and 7th
Nanango	6th and 7th
Dirranbandi	6th to 8th
Ipswich	11th to 14th
Wowan—	
Show	11th and 12th
Rodeo	13th
Crow's Nest	12th and 13th
Biggenden	20th and 21st
Gympie	20th to 22nd
Warrill View	22nd
Kilkivan	24th and 25th
Maryborough	25th to 27th
Charleville	25th to 27th
Maryborough	25th to 27th
Gin Gin	28th and 29th
Toogoolawah	28th and 29th
Kalbar	29th
Childers	31st May and 1st June

June.

Bundaberg	3rd to 5th
Lowood	4th and 5th
Boonah	9th and 10th
Gladstone	9th and 10th
Rockhampton	22nd to 26th
Marburg	18th and 19th
Mackay	28th June to 1st July

July.

Bowen	7th and 8th
Ayr	9th and 10th
Rosewood	9th and 10th
Cleveland	9th and 10th
Townsville	13th to 15th
Nambour—	
Show	15th and 16th
Campdraft	17th
Esk	16th and 17th
Charters Towers	20th and 21st
Laidley	21st and 22nd
Cairns	27th and 28th
Gatton	28th and 29th
Caboolture	30th and 31st
Maleny	22nd and 23rd

August.

Royal National, Brisbane	16th to 21st

September.

Imbil	3rd and 4th
Rocklea	11th
Innisfail	17th and 18th

Poultry Notes.

INCREASE EGG VALUES.

P. RUMBALL, Poultry Expert.

THE well-fed hen produces an egg of maximum food value, and it rests with the farmer to maintain this quality in order to obtain the maximum money value.

Quality and size govern price, quality being the more important. The lack of size is something easily determined, and by using for breeding only birds that lay large eggs, small eggs can almost be eliminated from the market.

To-day eggs of first quality are being retailed at 1s. 3d. to 1s. 4d. per dozen, and in the same street eggs of a similar size may be obtained for 8½d. per dozen. Why the difference? It is due to the internal and to some extent the external quality of the egg. The difference in price is so marked that the average consumer must wonder why, and, to some extent, look with suspicion on the cheaper article. But what of the producer responsible? Does he realise that he is losing at least 6d. per dozen on all the eggs that are sold at 8½d.? His loss is sufficient to pay for all the feed that the birds would consume to produce the better quality eggs; or, to put it in other words, he is going to all the trouble of caring for fowls, carting eggs to market, and incurring other costs without making a profit of one penny piece. Not only is this the case, but he is doing it to the detriment of the man who gives his eggs the necessary attention to maintain market quality, and who has to make his fowls keep him.

Cleanliness of shell is the first essential for the satisfactory marketing of eggs. There is only one degree of cleanliness, although there are several degrees of dirtiness. Cleanliness can be maintained by providing the stock with nests in which clean litter or nesting material is kept, and by gathering the eggs at least twice a day.

Water is usually used for cleaning. It should be changed from time to time, and the cloth used rinsed at frequent intervals. Before the eggs are packed they should be dried off thoroughly to prevent deterioration. Packing should be done in cases and fillers, as the use of materials, such as chaff, &c., soils the eggs; there is also the risk of infection of the egg content by moulds. This infection gains entrance through the pores of the shell.

At the bottom and top of the case, pads of wood-wool or other suitable material should be placed to act as a cushion. Exceptionally large eggs should always be packed on the top layer to avoid breakages, and if petrol cases are used only five layers packed per case.

As the quality of an egg deteriorates with age, frequent despatch to market is essential to secure the highest values. During summer, eggs should be railed twice weekly, and during winter at least once weekly.

Pending despatch, eggs should be stored in a cool place, free from odours, for taints are readily absorbed by the egg.

Many poultry farmers may not have a sufficient quantity to forward case lots twice weekly. To them, it is suggested that consideration be given to the possibility of combining with neighbouring farmers who are in a similar position.

The increased returns that will follow as the result of a little care bestowed on the egg to maintain quality will repay any farmer.

A New Type of Irrigation Sprinkler.

H. W. KERR.*

RECENTLY an interesting type of irrigation sprinkler was imported from England for experimental purposes. It was supplied in response to our demand for a simple and effective spray which would give a wide coverage, and therefore necessitate a small number of units per acre. The essential features of the sprinkler are shown in the accompanying illustration (Plate 115).

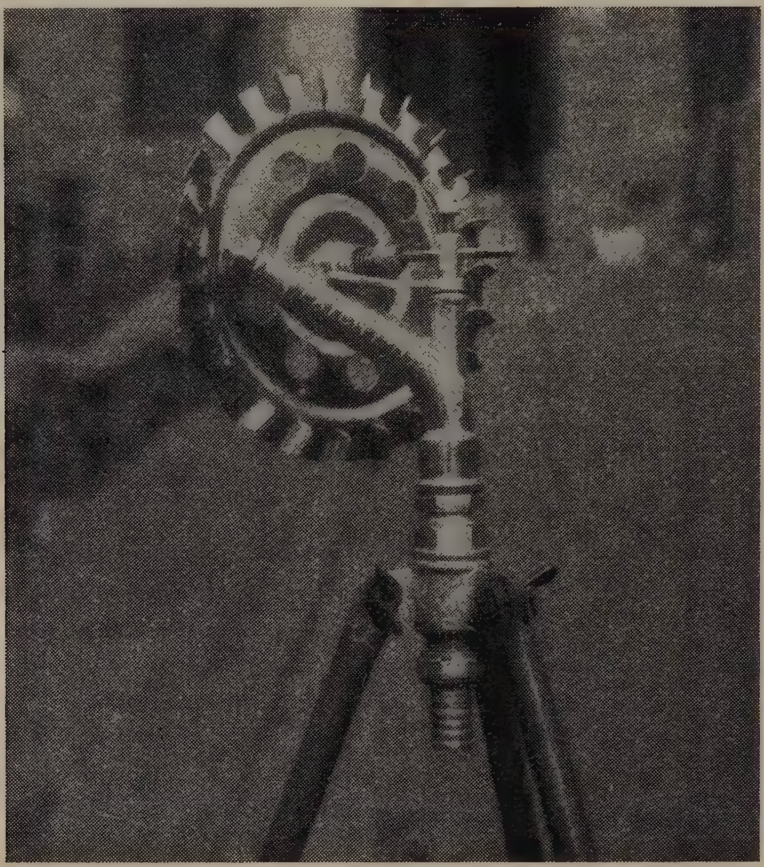


Plate 115.

Illustrating the essentials of the sprinkler head. It is mounted for convenience on a tripod with 5-foot legs.

The water is delivered to the sprinkler through a standard hose connection, and it is ejected through a nozzle set at an angle of approximately 45 degrees. A selection of nozzles is supplied with the unit, enabling one to employ that most suited to the volume and pressure of water available. The device by which the water spread is secured is simple and ingenious. The jet from the nozzle impinges on a wheel, the periphery of which is slotted. The force of the water causes the wheel to revolve, and the small fins break up the stream into drops of greater or less dimensions. A few of the fins are turned in such a manner as to offer a direct obstruction to the water flow, and the intermittent impulses caused by these gives the entire head a slow revolving action. Nozzle and wheel are thus carried through a complete circle in a period of from one to two minutes.

The manufacturers claim that the sprinkler will operate at pressures ranging from 10 to 100 lb., while a coverage of ½ acre is possible under the best conditions. The application of water ranges from 5 to 28 gallons per minute. depending on the pressure available and the size of jet employed. The coverage is likewise adjustable by these means. The model under trial was supplied for a $\frac{3}{4}$ inch hose connection, and the nozzles were from $\frac{5}{32}$ inch to $\frac{13}{32}$ inch diameter. This unit will irrigate $\frac{1}{4}$ acre. The larger model, with $1\frac{1}{2}$ inch hose connection, is intended for use with water pressures of 55 lb. or more. The nozzle sizes are from $\frac{7}{16}$ inch to $\frac{21}{32}$ inch diameter. This unit will deliver from 30 to 70 gallons of water per minute, and gives a coverage of from $\frac{1}{4}$ to $\frac{1}{2}$ acre.

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* Reprinted from the "Cane Growers' Quarterly" by courtesy of Dr. Kerr, Director, Bureau of Sugar Experiment Stations.

The price of the sprinkler is listed as £3, in England, and at this cost it should be of interest to many of our canegrowers. Though it suffers all the drawbacks previously outlined for spray irrigation, there are certain uses to which it might be put on the cane farm. As a means of irrigating the kitchen vegetable patch or a small block of horse feed, on a relatively low pressure, it should prove ideal, while to the grower who wishes to exploit intermittent irrigation on young cane, to help it through a dry spell when necessary, the sprinkler is strongly recommended. In this connection it should have a very definite value where the canegrower could provide water in a channel adjacent to the cane block; from this it could be taken up by a portable engine and small pump, and driven through two or three of these units suitably placed in the field of young cane. The advantage it offers, particularly where the water supply is limited, is its ability to enable a 1-inch watering to be applied uniformly and rapidly. On the average values given above for the large, high-pressure unit, 1 acre-inch could be applied to $\frac{1}{3}$ acre, by one unit, in the course of two and a-half hours.

AGRICULTURE ON THE AIR.

RADIO LECTURES ON RURAL SUBJECTS.

Arrangements have been completed with the Australian Broadcasting Commission for the regular delivery of further radio lectures from Station 4QG, Brisbane, by Officers of the Department of Agriculture and Stock.

On Friday of each week a fifteen minutes' talk, commencing at 12.45 p.m., will be given on subjects of especial interest to farmers.

Following is the list of lectures until the 30th April, 1937.

SCHEDULE OF LECTURES.

BY OFFICERS OF THE DEPARTMENT OF AGRICULTURE AND STOCK, RADIO STATION 4QG, BRISBANE (AUSTRALIAN BROADCASTING COMMISSION).

Friday, 12th March, 1937—"Plant Nutrition," by E. H. Gurney, Agricultural Chemist.

Friday, 19th March, 1937—"Sheep Management under the Varying Conditions in Queensland," by Jas. Carew, Senior Instructor in Sheep and Wool.

Friday, 26th March, 1937—"The Care of the Flock," by Jas. Carew, Senior Instructor in Sheep and Wool.

Friday, 2nd April, 1937—"Winter Pastures," by C. W. Winders, Assistant (Agronomy).

Friday, 9th April, 1937—"Pork Products as Regular Items on the Menu," by E. J. Shelton, Senior Instructor in Pig Raising.

Friday, 16th April, 1937—"Some Poultry Farmers' Problems. What to Breed and How to Breed," by J. J. McLachlan, Poultry Inspector.

Friday, 23rd April, 1937—"Strawberry Planting and Other Seasonal Fruit Hints," by H. Barnes, Director of Fruit Culture.

Friday, 30th April, 1937—"Wheat Improvement in Queensland," by R. E. Soutter, Agricultural Research Officer.

Identification of Rats Damaging Cane in Queensland Canefields.

W. A. McDOUGALL.*

DURING the many years prior to 1934 when rats damaged cane in Queensland, they were never referred to under any name but the common collective one of "rats." Undoubtedly, this name fully serves its purpose in several ways, but to those seriously interested in attempting to control these pests it is not sufficient.

The amount of research work done on any pest usually bears some relationship to the losses caused by the pest. This is well illustrated by happenings in the Herbert River cane areas during the past two years. There in 1933 and 1934, exceptionally heavy rat damage to cane was experienced. Control measures were applied, but a further result of these heavy infestations was that work was commenced by local mill and pest board officers to find out something of the habits, &c., of the particular rats with which they were dealing—i.e., of the rats which were found to be pests of cane. At an early stage the different kinds of rats were separated and were submitted for identification to competent authorities. Three species were found to be of interest to the cane farmer—viz., *Rattus rattus, Rattus culmorum,* and *Melomys littoralis.*

Unfortunately, at the present time, very little is definitely known about rat species in Queensland cane districts, other than the Herbert River, and knowledge of the wider distribution of some of the important species occurring there is very scant.

Rattus rattus (the House Rat) is a world-wide species but, as far as is known, it is not a very serious cane pest in Queensland. *Rattus norvegicus,* the species which is considered as being of considerable importance as a pest of cane in Hawaii, has not been reported, as yet, as damaging cane in Queensland, although it is present in cities of the State. The known locality records of *M. littoralis* are Cairns, Ingham, Innisfail, and Ayr. Specimens of *R. culmorum* have been identified from Ingham, Ayr, the Innisfail district, and from the Habana area of Mackay (November, 1935). At the present time this last-mentioned species, which is native to the country, is considered to be of the most importance to Queensland cane farmers. Under such circumstances it is very desirable that as much as possible should be known about its distribution, habits and characteristics, and the farmer should be able to distinguish it from other rats. As an aid towards these ends the following brief descriptions of some of the rats which may be found in cane in Queensland are set out below, together with the correct method for forwarding rat specimens to any of the Sugar Experiment Stations. Farmers are requested to do this as it will be of considerable help in increasing our knowledge of rats and their distribution in Queensland cane areas. Some species of the coast areas of Queensland had not been recorded since first found and described many years ago. Rats from both canefields and outside country are desired; if taken from canefields it is suggested that the specimens should be taken from spots not in close proximity to buildings.

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* Reprinted from the "Cane Growers' Quarterly," by courtesy of Dr. Kerr, Director, Bureau of Sugar Experiment Stations.

Rattus rattus (the House Rat).

The total length of the head and body of a full-grown adult of this species is about 8 inches. Its colour is very variable. The fur is fairly soft but sparse and the lack of thick under-fur gives the coat, as a whole, a somewhat thin, harsh quality. The ears are large, almost free of hair, and leafy in appearance. This species can be distinguished from the others by its extremely long, slender tail which, when held

Plate 116.
Tree-rat nest in Pandanus.

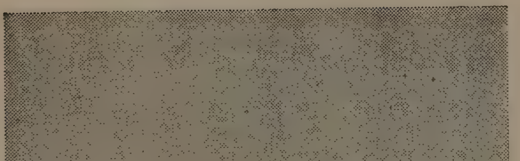


Plate 117.
(*a*) House rat (*Rattus rattus*).
(*b*) Field rat (*Rattus culmorum*).
(*c*) Tree rat (*Melomys littoralis*).

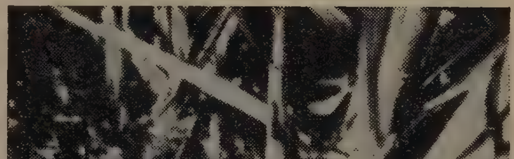


Plate 118.
Typical field rat burrow entrance under a cane stool.

[*Photos. after Gard.*

back over the body, reaches an inch or more beyond the tip of the rather sharp nose. Although known as the "ship" and "house" rat it is also found in the bush.

Rattus culmorum (the Coarse-haired or Spiny-haired Rat).

In the Herbert River district this species is called the Field Rat. It is usually smaller than the House Rat and the fur is much denser but rather coarse, and the presence of more or less numerous flattened spines gives the coat a harsh touch and appearance. The general colour, although variable, is dark-brownish flecked with lighter buff-brown. The sides are greyer and the belly is duff-white, often with a tinge of yellow, but never pure white as in some individuals of *Rattus rattus*. The muzzle is not as pointed as in the House Rat. The ears are short and practically naked. The tail when held back over the body reaches to about the shoulders.

Melomys littoralis.

This rat is called the "Tree," "Fruit," "Banana," or "Khaki" rat by farmers in the Herbert River mill areas. The last-named is a reasonably fair indication of its colour. In size it is much smaller and it is softer haired than the three *Rattus* species previously mentioned. It differs from them also in the number of teats; instead of 10-12 the female possesses 4 only. The main character of the genus Melomys is the almost naked tail with its patterned instead of ringed scales.

Preparation of Rat Specimens.

If "break-back" traps are being used the specimen should be collected as early as possible during the first morning of its death. Before it is placed in undiluted methylated spirits a slit of about 2 inches should be made along the centre of the belly of the dead rat. Specimens should not be crowded into receptacles (preferably air-tight) and they should be well covered with the preservative. After a week or more—i.e., when the flesh is well hardened—the specimens may be wrapped in some material, such as cotton wool or rags which will absorb spirits. Then the specimens, with wrapping well saturated with spirits, may be packed in leakless tins or other suitable containers for forwarding to the desired destination.

TREES ON THE FARM.

When a selector first obtains his license to occupy his newly acquired selection, his first objective is to fall the scrub, grass the land, and so make it revenue-producing as soon as possible. A commendable idea, but in his enthusiasm, the selector very often overlooks the fact that his stock will require shade in the summer and protection from cold winds in the winter. If every tree on the selection is cut down, neither shade nor shelter is available. As the summer approaches, cattle and horses look for shade, and in winter they seek shelter from the cold winds, but as the farmer has omitted to leave any trees standing, the cattle do a "perisher." As a consequence, the milk yield diminishes considerably and the cattle lose condition.

When clearing new land, it is always wise to leave a small patch of scrub standing here and there. If a complete clearance of timber has been made the advisability of planting a few weeping fig trees or other good shade trees on the farm shoud be considered. In ten years' time they will be quite big trees giving cool and ample shade to stock when summer comes. The planting of a few well-known timber trees in forest formation is also worthy of consideration.

Pineapple Disease.

A CAUSE OF POOR GERMINATION IN CANE.

A. F. BELL.

PINEAPPLE disease has not frequently been reported in Queensland, but particular attention was drawn to it some four months ago when it was an important factor contributing to the almost complete failure in germination of a sixty-acre planting in the Lower Burdekin district. It is possible that pineapple disease is responsible for considerably more bad strikes than are attributed to it; accordingly the symptoms

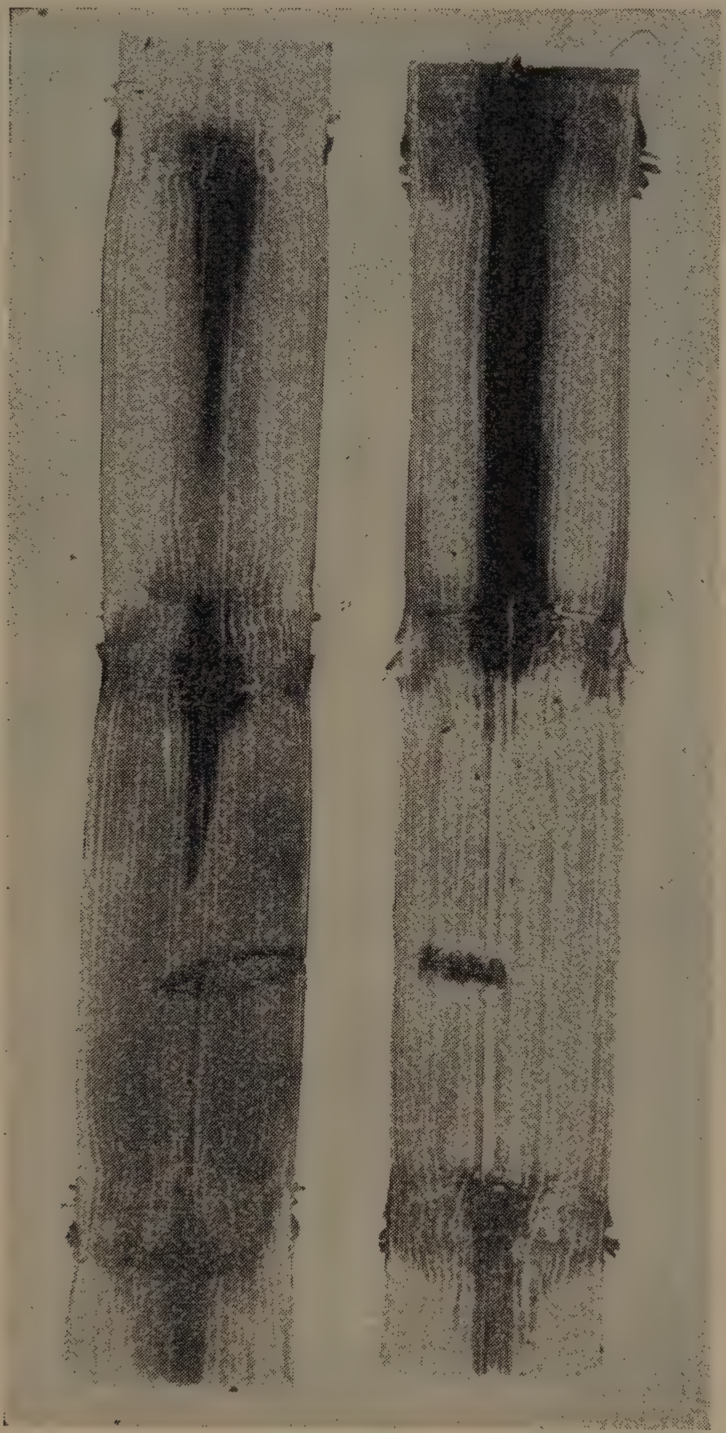


Plate 119.

A B

Pineapple disease of sugar cane produced by inoculation of setts. The lower part of A shows the general reddish discoloration of the flesh caused by the disease, while in B may be seen a good example of the sooty black core characteristic of later stages.

are described and illustrated here in order that the disease may be recognised and reported to our field officers when it occurs.

Pineapple disease is caused by a fungus which also causes the water blister of pineapples, while a similar fungus attacks the banana. At times standing cane may be attacked, but for the most part it is a disease of cane setts which becomes infected after they have been cut. The first symptom which can be seen is a light-red discoloration of the internal tissues or ''flesh'' of the cane (see Plate 119, A). Later, usually commencing at the cut surfaces, the colour changes to black, due to the production of the spores or ''seeds'' of the fungus. This black colour frequently extends into the inner joints in the form of a sooty core (see Plate 119, B). Perhaps the most striking symptom is the fact that when cut open many of the diseased setts give off a fruity odour very similar to that of a ripe pineapple.

Once the fungus has invaded the cane sett it soon penetrates to the buds and causes them to rot, thus prohibiting germination. Any condition which delays germination will tend to allow the fungus to enter and spread through the sett, destroy the eyes, and so ultimately prevent germination. Planting during weather which is too cool or too dry for a rapid strike, or placng too heavy cover on the setts, are among the conditions which tend to favour damage by this disease.

Considerable losses have been caused by pineapple disease, particularly in the British West Indies, where cane setts are sometimes soaked in Bordeaux mixture before planting as a means of control. Owing to its infrequently reported presence in Queensland, no control measures have heretofore been considered necessary, but investigations are being carried out at the present time in the pathology laboratory.

Plate 120.
THE ROAD MAKERS.—Wambo Shire: Darling Downs-Burnett Highway (Malakoff Road)—Cement penetration, flood section under construction.

Agricultural Notes

COTTON.

THE rainfall experienced during the month in all of the cotton-growing districts, save in the south-eastern parts, has been of sufficient amounts to promote very satisfactory growth of the cotton plants. The earlier plantings are carrying good crops of well-developed bolls, and in some areas picking was in progress at the end of February. Given sufficient rainfall of moderate intensity during early March, it would appear that many growers will have excellent prospects of producing satisfactory yields.

The splendid progress that is being made by most of the cotton crops in all districts, save the south-eastern ones, where very limited rainfall has retarded development, indicates the ability of the cotton plant to produce satisfactorily under climatic conditions unfavourable for most other crops that can be grown economically in this State. Although appreciably delayed planting of the cotton areas was the general experience of most farmers this spring, and such adverse conditions ruled during the early summer as to seriously affect most farm crops, cotton has progressed very satisfactorily except in the outstandingly distressed areas, and the yields produced will contribute an appreciable portion of the returns that many farmers will obtain this season. Undoubtedly cotton-growing should occupy an important position in the crop rotation practised by many farmers of the main agricultural districts of this State.

SUGAR.

In all cane areas from Mackay northwards growing conditions in the cane areas during the month of February were generally favourable. However, no heavy rains had been received in the far northern districts, and the crops were beginning to suffer.

The drought situation in the southern areas was virtually broken by continued showery conditions during the month; and with a continuance of favourable weather conditions, a satisfactory crop may yet be produced in those parts.

WINTER FODDER CROPS IN SOUTHERN QUEENSLAND.

OWING to the abnormally dry conditions prevailing in the main farming areas during the spring and early summer months, it has been very difficult to establish summer fodder crops, and few have been fortunate enough to bring such crops to maturity.

Farmers should, therefore, take the opportunity of ultilising the large area available for the sowing of winter fodder crops in order to supplement natural pastures and replenish reserves. Under normal conditions the paddocks are prepared after the removal of early sown maize or summer fodder crops, and approximately two months are available to cultivate and fallow the land before commencing seasonal sowings during late March. A thorough ploughing, cross-ploughing, disc or tine cultivation, and harrowing will form a suitable seed-bed on average soils. Succession sowings can be made during April and May if desired, while if seasonal rains are delayed sowings can be extended to early July with reasonable prospects of securing good grazing for a limited period.

Statistics show that an area of oats approximately 100,000 acres in extent is sown annually in Queensland for grazing and green fodder purposes, with smaller areas of wheat and barley used in the same way. These cereals can be combined, with legumes such as field peas, vetches, or tares, thereby providing a richer and more balanced ration.

Drilling methods of planting are preferable, as the seed can be placed at the correct depth. In the absence of suitable machinery, broadcasting is generally practised, sowing the legume first and discing or cultivating in, following with the cereals, which are broadcast and harrowed in.

Of the varieties utilised, Florence, Warren, or Warchief wheat, Sunrise Belah, or Algerian oats, and skinless barley, have proved suitable. Florence wheat 30 lb. and Dun field peas 20 lb. has proved a suitable mixture, as both are fairly early maturing. Algerian oats 30 lb. and vetches or tares 20 lb. per acre is also a suitable combination, being somewhat slower maturing than the former. The earlier maturing varieties of oats, such as Belah and Sunrise, may also be sown with field peas if desired.

Besides adding to the value of the forage, the addition of a legume provides an excellent rotation crop of considerable benefit to the soil.—H. W. BALL, Assistant Experimentalist.

THE FUNGICIDAL TREATMENT OF SEED POTATOES.

Seed potatoes showing the presence of either common scab or black scurf should be treated with a fungicide before planting, otherwise, given the necessary weather conditions, considerable damage may be done by one or both of these diseases to the resulting crop. Two methods are available for the purpose. One employs hot formalin solution and the other acid corrosive sublimate. The latter is more convenient, as no heat is required. The potatoes should be washed but not cut before treating.

Prepare the formalin solution by mixing 1 pint of commercial formalin (40 per cent. formaldehyde) with 15 gallons of water. Heat to 125 deg. Fahr. and arrange for maintaining the temperature at this point by building a small fire under the tank or by keeping some of the solution hot in a boiler so that a little of this may be added from time to time as the rest cools. No more than a 5 deg. variation in temperature either way during the operation should be allowed. Dip the seed tubers into the solution for two and a-half minutes in successive small quantities in crates or upon sacks. Remove, and after draining excess solution back into the tank, cover the potatoes with bags or canvas for one hour to keep in the formalin fumes. Finally spread out to dry before planting.

The acid corrosive sublimate solution is prepared by adding ¼ lb. of corrosive sublimate and 1¼ lb. of hydrochloric acid (spirits of salts) to 12½ gallons of water. A wooden or well-painted vessel must be used, as this mixture corrodes metal. When all the corrosive sublimate has dissolved, immerse the tubers (in lots of convenient size) for five minutes, and then spread out to dry. The dipping is preferably carried out in wooden crates rather than bags. The solution loses its strength gradually, so that a fresh quantity should be made up after ten successive lots have been treated.

Acid corrosive sublimate must be used on dormant tubers and not on ones which have sprouted, otherwise some injury or delay in germination may occur. Treatment may be carried out three or four months before planting. Corrosive sublimate is a deadly poison and must be used with care. All treated tubers must be planted or buried to avoid the possibility of their being consumed by any person or domestic animal. The solution may cause some irritation to the hands unless they are greased well before immersion.

These treatments are only effective if the soil on which the crop is grown is free from the parasitic fungi causing the diseases. It is of little use treating seed to be planted in land which has borne a badly diseased crop of potatoes within recent years.—J. H. SIMMONDS, M.Sc., Senior Pathologist.

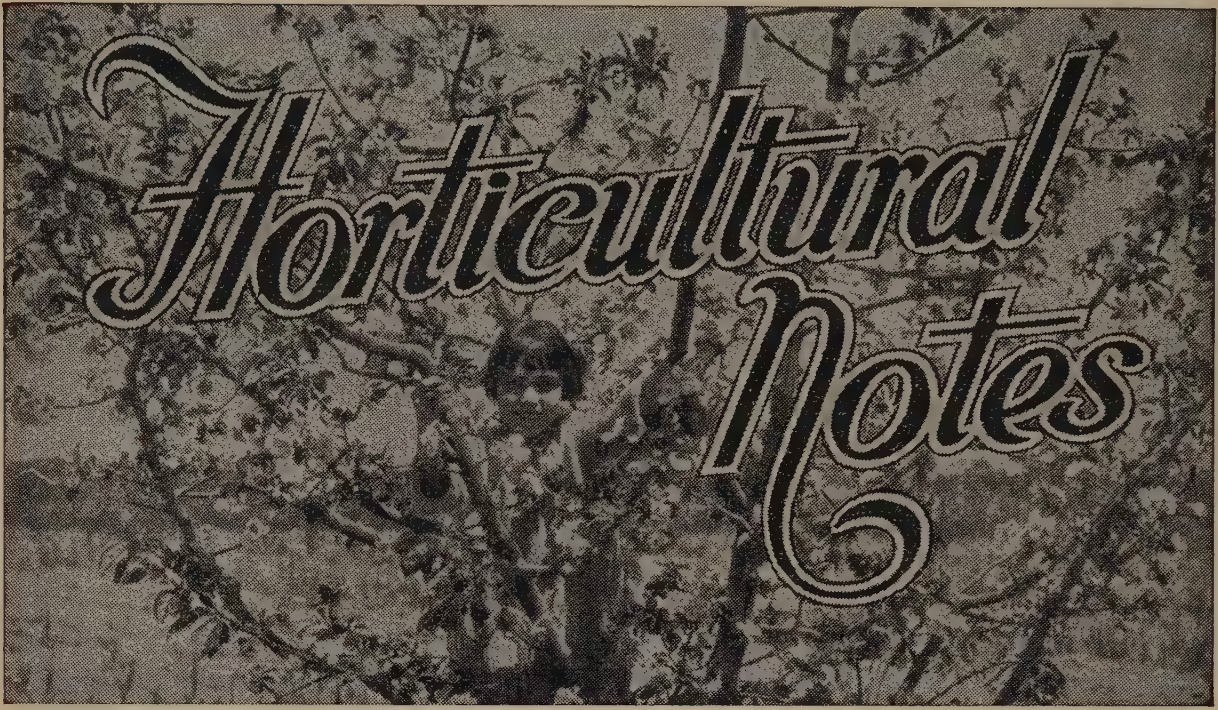
JERUSALEM ARTICHOKE.

Like the sweet potato, Jerusalem artichoke is a crop which should receive much more attention than it does at present, more particularly by those engaged in pig-raising in the western farming districts, for not only is it highly drought-resistant but its tubers are highly nutritious as well. The yield, which is controlled by the soil and seasonal conditions, may range from 300 to 500 bushels or more per acre, and although the plant does best on good friable loams, it will thrive on sandy, gravelly, or clayey soils, which enables the poorer patches of soil on a farm to be put to a profitable use.

The area intended for its reception should be prepared in much the same way as if it were intended for potatoes. It may be planted in early spring in furrows three feet apart, with the sets two feet apart. This spacing with medium-sized tubers will entail the use of between 4 and 5 cwt. per acre.

As with maize and potatoes, until the crop is 4 inches high all cultural operations can be carried out with tined harrows working across the drills. Afterwards the cultivator will have to be used, as the condition of the soil and weed growth necessitates.

When the tops die, the crop is fit for harvesting, which can be accomplished most profitably by turning pigs on to the field. If it is intended to plant the same area in the succeeding season, it will be necessary to remove the pigs before all the tubers have been eaten, if replanting is to be avoided. The area should be cultivated in the spring. Subsequent working will be similar to that of the first season. The white and red varieties are considered to be the most hardy and prolific.—R. SOUTTER, Agricultural Research Officer.



PASSION FRUIT GROWING ON THE SOUTH COAST.

J. McG. WILLS, Fruit Branch.

[*Continued from page 209, February, 1937.*]

SELECTION OF SITE.

THE site for the vineyard should be carefully chosen. Here are six important factors to be considered before making the final selection:—

1. Aspect;
2. Elevation;
3. Shelter;
4. Soil;
5. Drainage;
6. Accessibility.

Aspect, elevation, and shelter in many instances will go together, as a good aspect is often elevated and sheltered by higher ground at the rear.

Secure, if possible, an aspect open to the early morning sun, backed by good solid natural growth or rising land to provide protection from strong winds. The site should also be sufficiently high above sea-level to escape the frosts. It should be sheltered from all cold winds, particularly those from the south and west, and for preference should have an aspect of from east to north. Such an aspect is naturally warmer and well protected, thus exerting a marked influence on the early maturity of the vines and the production of large crops of high-grade fruit which colours and ripens evenly and more rapidly than fruit grown in vineyards less favourably situated. Avoid the tops of ridges even when they have the desired aspect, as the soil may have been badly washed, leaving a low humus content. Vines rarely grow vigorously when planted on such sites.

Situations so heavily timbered that the free movement of air is prevented or seriously restricted should not be considered, unless provision has been made to allow the cold air to pass down the lower levels; otherwise frosting or severe chilling may result.

While the passion fruit vine is not very exacting in its soil requirements and will establish itself rapidly on most of our coastal soils, good natural drainage is absolutely essential. Any situation which may possess all the other qualifications will be unsatisfactory if lacking in natural drainage, for the vines will eventually fail, as stagnant water and sour soil conditions are absolutely fatal to their development. The best type of soil for passion fruit growing is more or less a matter of divided opinion. Vines have been grown successfully on many classes of soil ranging from rich vine scrub to poor forest and coastal sand. Provided the soil is put in a good mechanical and physical condition and is not underlaid by any impervious clay subsoil, the vines appear to establish themselves rapidly and flourish, eventually producing crops of good-quality fruit. It is generally acknowledged that good vine scrub soil is richer than forest soil, and tends to produce heavy foliage on the vines; also there is a tendency for the vines to produce a more rank, vigorous growth, which becomes rather a disadvantage in that extra work is entailed keeping the growth in check and combating fungus diseases to which the vine is subject.

Plate 121.

New land prepared for further planting. Established area adjacent. Russell Island, Moreton Bay.

Good forest land will produce a vine of good average growth without the tendency to excessive production of wood growth, while the cropping propensities of the vine are nearly equal to that of vines grown on scrub lands—a distinct advantage, as there is less trouble and cost in controlling the vine growth and combating fungus diseases. In good forest country a retentive subsoil is also a distinct advantage. Normally, forest soils do not possess as great an amount of organic

Plate 122.

The entrance to Canaipa Passage, Stradbroke Island in the background. The launch is engaged in regular inter-island transport, in which passion fruit makes up a large proportion of consignments, in Moreton Bay.

matter as scrub soils; consequently it is impossible for forest soil to absorb and retain sufficient moisture to meet the demand of a heavy crop in very dry seasons.

Forest soils require considerably more working in order to bring them into a satisfactory physical condition, as they are seldom as deep or friable as scrub soils.

Plate 123.

An established passion fruit vineyard at Springbrook on one of the numerous small, richly fertile plateaux of the Macpherson Range, bordering New South Wales in the south-eastern sector of Queensland.

Very heavy types of soil should not be planted with passion fruit, as the natural drainage is usually poor; while soils having a heavy clay subsoil close to the surface should be left out of consideration.

In common with the banana, passion fruit does well on stony ground, and the presence of surface stone or "floaters" is not detrimental, provided the body of soil is sufficient. Where the surface is stony, cultivation costs will obviously be increased. However, this disadvantage is offset by the prevention of surface soil erosion, retention of soil moisture during dry periods, and the maintenance of a higher soil temperature during winter. This higher soil temperature during the cold months maintains the plants in a more vigorous growth, resulting in a more rapid response to spring conditions and, generally, more satisfactory conditions throughout the year.

Drainage.

As mentioned elsewhere, the passion fruit vine will not thrive under excessive wet or sour soil conditions, stagnant water being absolutely fatal to the plants. Throughout the South Coast there is a very high rainfall, and during normal wet seasons half the annual rainfall may be precipitated during two to three months; therefore the need for adequate natural drainage is obvious. No matter how rich the soil may appear to be, if it is sour or badly drained it should not be planted, unless satisfactory provision can be made to improve this condition by effective drainage, thus lowering the watertable beneath the depth—at least 2 feet—required by the roots of the plants.

High land has the advantage of being drained sufficiently and naturally to cope with even the wettest periods of the rainy season, without permitting wet soil conditions to develop to such an extent that any harmful effect will be noticed on the vines.

The soil should be well broken up to a depth of at least 6 inches and the surface afterwards maintained in a good cultural condition. As a safeguard against surface soil erosion, contour drains should be constructed across sloping land. These drains should be as short as convenient, with a slight fall in order that the rain run-off will not flow too rapidly or with the strengthening volume force of water that occurs in steeply-graded channels.

On flat land where natural drainage is at all faulty, consideration must be given to the construction of deep main drains at regular intervals, into which a series of shallower drains will carry excess water. If this is not possible, through financial or geographical limitations, then the site should be abandoned.

Accessibility.

The method of cultivation used will be decided mainly by the contour of the land. Mechanically or horse-drawn cultivators, where they can be used, are more economical than man power. The presence of logs, stumps, boulders, stony and uneven surfaces all increase the expenditure of time and labour in the performance of cultural operations, as so much work must be done by hand.

On sloping land the packing shed should be erected in such a position that a wiring system can be installed conveniently. By this means fruit can be quickly and safely despatched from numerous suitable positions in the vineyard, so greatly reducing harvesting costs. The location should be, if possible, within reasonable distance of a railway siding or other suitable forwarding centre.

If the fruit has to be conveyed many miles by truck a good road is necessary; otherwise delivery may be interrupted by floods or the roads becoming impassable for several days during wet weather.

It is advisable to fix on a situation from which the fruit can be despatched uninterruptedly, as the daily despatch of fruit to the market is most desirable and any disorganisation of transport may result in heavy loss to the grower.

[TO BE CONTINUED.]

FRUIT MARKETING NOTES.

JAS. H. GREGORY, Instructor in Fruit Packing.

GENERALLY, the market has been firm for all fruits during the last few weeks. Many of the coastal fruits are only beginning to show the effects of the prolonged dry spell.

Stone Fruits.

Plums.—Local supplies have now practically ceased. New South Wales plums—Ponds and Grand Duke—are realising 5s. to 8s. per case, some fine quality coming on to the market.

Peaches.—Stanthorpe peaches are realising 2s. to 5s. per half-bushel for good-quality fruit. The season is now drawing to a close. Supplies have not been as heavy as usual, and prices have remained firm. Victorian peaches, 9s. to 13s.

Grapes.—Excellent fruit has been available throughout the season. Prices have remained firm, with Muscats and Walthams most popular. Prices per half-bushel case: Waltham Cross, 5s. to 7s.; Muscatels, 4s. to 5s. 6d.; Black Prince, 3s. 6d. to 4s. 6d.; Colemans, 3s. 6d. to 4s. 6d.; Hamburgs and Ascots, 3s. to 4s.

Apples.—The demand for cookers and Granny Smiths has eased owing to the prevalence of green fruit on the market. Some excellent Jonathans have been seen, and obtained good prices. Jonathan, 6s. to 9s.; Granny Smith, 6s. to 8s.; Delicious, 6s. to 8s.; King David, 4s. to 8s.

Pears.—Only choice-quality pears were popular, poor lines being hard to move; 4s. to 6s. per case being top prices, with an occasional extra special line at 7s.; Victorian and New South Wales, 8s. to 9s.

Export Consignments.

Apple export consignments are now in full swing. Care is necessary if consignments are to arrive in good condition. Close attention should be paid to labels, &c., in order to ensure that the general get-up is as near perfect as possible. Attach labels securely. If the label becomes unattached, the fruit loses its identity and trade description. Place labels on squarely. Do not pencil in particulars. It is not permitted, and in any case is only a third-rate method of doing things. Wiring should be carried out with care, so that no undue pressure is brought to bear on the fruit. Keep the wires at the ends of the cases. Stencil cases neatly and cleanly.

These are little points noted at the ship's side which spoil the perfection of many consignments.

Tropical Fruits.

Pineapples.—Heavy supplies are coming to hand, and prices have eased. The position is being complicated by the high percentage of sunburned fruit sent on to the market. Prices: Brisbane, cases, 2s. to 5s. for Smooths; loose, 6d. to 3s. per dozen; Ripleys, 4s. to 6s. 6d.; loose, 6d. to 3s. per dozen. Sydney, Smooths, 6s. to 9s. Melbourne, Smooths, 8s. to 10s. Many lines have arrived in leaking condition. Some lines are also green. Water blister has been noticeable.

Bananas.—Supplies have been maintained, fruit generally being still on the thin side. November dumps are now making their appearance in increasing quantities. Prices: Brisbane, Sixes, 7s. to 11s. 6d.; Sevens, 7s. to 12s. 9d.; Eights, 8s. to 13s. 6d.; Nines, 8s. to 14s. Sydney, Sixes, 11s. to 13s.; Sevens, 12s. to 14s.; Eights and Nines, to 17s. Melbourne, Sixes, 12s. to 13s.; Sevens, 13s. to 15s.; Eights and Nines, 15s. to 16s.

Prices are inclined to show a downward trend. Many lines have been marked down in grade; growers should take every care to keep up to the grade. The smallest fruit in the case should indicate the grade, and the case should be marked accordingly.

Mangoes.—It has been an excellent season for quality mangoes. Supplies are now diminishing. Prices: 4s. to 5s. for commons; special varieties higher.

Papaws.—Supplies are short, prices being maintained at high levels. Brisbane prices: Locals, 5s. to 6s. per bushel; Yarwun, 10s. to 11s. per tropical case. Sydney, 12s. to 16s. tropical case.

Passion Fruit.—Supplies are now plentiful; for average lines 4s. 6d. to 5s., and for specials to 7s. are the prevailing prices on the Brisbane market.

There are some excellently packed lines obtainable, but one still sees the old haphazard "throw them in" methods in use. It pays to pack this fruit. Sydney, 6s. to 12s. per half-bushel. Melbourne, 4s. to 7s.

Citrus Fruits.

Lemons.—Lemons are still maintaining exceptionally high rates on the Brisbane market. Gayndah and Benyenda, 20s. to 21s. per case; small and second grade, 10s. to 16s.; Locals, 14s. to 16s.; Victorian, 13s. to 16s. Melbourne, 6s. to 16s. Sydney, 6s. to 14s.

Oranges.—No local supplies available, New South Wales realising 9s. to 13s. Sydney, Valencias, 6s. to 11s. Melbourne, Valencias, 6s. to 16s.

Grape Fruit.—No local supplies are yet on the market. Early consignments should attract good prices, particularly in Melbourne, where 14s. to 30s. is the present price for imported fruit. Some special selected fruit realised up to 40s. for the 1½-bushel citrus export case.

Tomatoes.—Market demand steady for good tomatoes in Brisbane, good coloured lines selling to 7s. Ripe fruit, 3s. to 6s.; green, 3s. to 5s.

Sydney quotes Queensland tomatoes from Stanthorpe 3s. to 5s. Local supplies, 4s. to 7s.

Miscellaneous Fruits.—Rock Melons, Brisbane prices, Stanthorpe, 3s. to 5s. a bushel case. Quinces, 2s. to 3s. per case. Monstera, Brisbane, 4d. each; Melbourne, to 1s. each; Figs, 4s.; special boxed dessert, 9d.

General.

Banana growers are requested to watch for a change in packing methods with the introduction in New South Wales and Queensland of the cluster pack. A bushel container is also to be introduced. Experiments over three years indicate that better marketing conditions will prevail with the adoption of the contemplated changes.

Plate 124.

The Road Winding Ever Upwards.—The new Nerang-Beechmont road replaces a narrow mountain track shown near the right of the picture.

The Tropics and Man

TEMPERATURE, HUMIDITY, AND AIR-MOVEMENT.

DOUGLAS H. K. LEE, M.Sc., M.B., B.S., D.T.M., Professor of Physiology,
University of Queensland.

No. 3.

AT the close of the last article, you will remember, I pointed out to you that the difficulties the human body had to contend with in getting rid of its surplus heat were bound up with the three climatic factors of temperature, humidity, and air-movement. These three are so important that, in spite of my assurances last time, I am going to discuss them separately a little more fully before passing on to Queensland climates in particular.

Heat Factors in Climate.

There is no need to delay over the factor ''temperature.'' Everyone knows that the unqualified word ''temperature'' refers to the reading given by a naked dry mercury thermometer, and that when the meteorologist speaks of temperature, he refers to the reading made with this thermometer in a standard box with louvres, and thus shaded from the sun. There are other kinds of temperature readings, such as wet-bulb, sun, and ground temperatures, but these have special meanings and are not usually confused with the ordinary ''temperature.'' As I indicated in the February Journal, the temperature of the body's surroundings is important, because, other things being equal, the loss of heat from the body by radiation and conduction depends upon how much cooler these surroundings are than the human body. If, as sometimes happens in desert climates, the surroundings are hotter than the body, the body gains heat instead of losing it by these paths.

Humidity probably requires a little more description. Everyone knows that it means the moisture in the air, but few realise its exact meaning or the fact that its measurement is now of great importance in comparing climates one with another. The term ''absolute humidity'' is not of much use in climatology; so just note it in order to avoid confusion if it crops up at any time. The term ''relative humidity'' is of great use, however. It is a comparison between the amount of moisture the air actually is holding and the amount of moisture it could hold at the same temperature. On the western plains the relative humidity is usually 20 per cent.—i.e., the air contains only one-fifth of the moisture it could hold if given the opportunity. On the coast, the relative humidity lies between 60 and 80 per cent., so that it can take up much less extra water vapour than inland air. Evaporation will, of course, go on much more readily when the relative humidity is low than when it is high. Clothes and perspiration dry very much more quickly in the interior than on the coast.

How is this relative humidity measured? In the first place, of course, it was measured by the cumbersome process of extracting all the water from the air and measuring it, and then seeing how much water the perfectly dry air would take up when given full opportunity. Men soon found out, however, that the reading given by an ordinary thermometer wrapped in wet lint had an important relation with relative humidity. Now all the meteorologist does is to read the ordinary (dry bulb) thermometer and this wet bulb thermometer, refer the readings to a standard table, and read off the result. All perfectly easy, but what of the men who worked out the table in the first place?

It is because the ''relative humidity'' determines how quickly water (or sweat) will evaporate at a particular temperature that it is so important to us. On dry days sweat can evaporate very readily and thus help tremendously in cooling the body (or in over-cooling it if we are foolish enough to let it get the chance), but on wet days sweat evaporates slowly and is a much less efficient servant.

Air-movement is, of course, a most familiar thing, and a very welcome visitor in hot, steamy coastal regions. Its contribution to comfort lies in removing the layer of air in contact with the skin which has become loaded with heat and moisture, and replacing it with cooler and drier air to which the body can give away more heat and more moisture. If the air is very dry, a very small amount of air-movement will suffice to ensure evaporation of all skin moisture, but the more humid the air the greater the air-movement required. As long as the air is cooler than the skin, increased air-movement will increase heat-loss; but when the air is hotter than the skin, increasing the air-movement will increase heat-absorption of the body. For these reasons, air-movement is very much more valuable in hot humid climates in which the temperature is seldom higher than that of the body, and humidity is high, than in hot arid regions, where temperatures are often higher than that of the body, and humidity is low.

The Measurement of Co-operative Effect.

A suspicion has probably arisen in your minds by this time that if these three factors of climate all interfere in some way with the loss of heat from the body, and if they can all be measured and dealt with intimately by prying scientists as the technical jargon you have been reading suggests, there ought to be some method of dealing with them on a common footing and of expressing their combined result in some simple measurement that all can appreciate. Now that idea, believe it or not, occurred to some of these technically-minded scientists, and attempts were made to devise some formula which would be true to facts and yet yield some simple method of assessing the net effect upon heat-loss from the body of any given set of atmospheric conditions. Two very interesting and important results were developed. The first was evolved by Leonard (afterwards Sir Leonard) Hill and his colleagues in London towards the end of the war, whilst investigating conditions in war-time industry. This was a special instrument known as the katathermometer, which, instead of measuring temperature, measured the rate at which it lost heat in a given atmosphere. This was very good, and could be made to imitate a clothed or naked, a wet or dry body. It possessed certain disadvantages, however, which prevented its universal adoption. It is now used chiefly as a sensitive instrument for measuring variable small air-movements, for which purpose it remains very valuable. The most practical scheme was developed in America by Houghten, Yagloglou (the Americans soon shortened this to Yaglou), and others. These workers had two rooms in which they could produce any combination of temperature, humidity, and air-movement they desired. They performed many thousands of experiments in which human subjects were placed in one room until they got used to it and then transferred to another room and asked whether they felt hotter or colder. These experiments involved an enormous amount of work and took a long time to complete, but the results were very much worthwhile. From the enormous number of answers they were able to plot out a somewhat complicated diagram (what engineers call a nomogram) in which these three factors could be conjointly assessed. They then coined the term "Effective temperature"—a term which has come to stay. The *effective temperature* of an atmosphere is the temperature at which a still atmosphere saturated with water vapour would have to be in order to have the same general effect upon the body. Let me illustrate this difficult definition with an example. An atmosphere with (dry bulb) temperature 76 degrees, wet bulb temperature 62 degrees, and wind velocity of 100 feet per minute would have the same general effect upon the human body as a saturated still atmosphere with (dry bulb) temperature 70·2 degrees. The *effective temperature* of the first atmosphere is, therefore, 70·2 degrees. Again, an atmosphere at 110 degrees dry bulb temperature, 90 degrees wet bulb temperature, and no air-movement would have the same general effect as a saturated still atmosphere with 94 degrees dry bulb temperature; its *effective temperature,* in other words, would be 94 degrees. By means of this scheme, therefore, it is possible, with some degree of accuracy, to compare one set of atmospheric conditions with another, *in so far as they affect the human body.* One notes the dry and wet bulb temperature and the wind velocity of each atmosphere and determines the "effective temperature" of each from the standard chart. These "effective temperatures" mean something comprehensible and can easily be compared. In the next article I shall show you how the climates of different parts of Queensland can be compared, one with another, by means of this scheme, and assessed in respect of their general effects upon the human body.

[*Next issue: "The Climates of Queensland."*]

SHELTER FOR PIGS.

Protection from the extremes of weather is essential for the health and economical growth of pigs. During hot weather it is obvious to the observant pig raiser that pigs require cool shade and they even enjoy a bath in a wallow or muddy pool. A number of pigs die each summer from headstroke, which affects the fatter pigs and those which are deprived of cool shelter.

Whilst the wallow is a means of cooling pigs, it is a probable source of infection unless it is well constructed of concrete and capable of being emptied and cleaned frequently. The wallow should also be covered with a roof or a tree to protect pigs from the sun while bathing.

Cool shade can be provided for pigs by the ordinary shelter sheds as recommended in the department's bulletin on pig accommodation, provided the sheds are constructed with the roof not less than 6 feet from the floor at the lowest part, and provided there is a ventilation space of at least 6 inches between the top of the walls and the roof. The front should be at least partly open and the shed faced to the north-east; this latter provision allows the direct sunrays to enter the shed in the early morning, acting as a disinfectant, then, as the temperature increases later in the day and the pigs require shade, the sunrays are on the northern and western walls of the shed, thus leaving the interior shady for the pigs.

A supply of clean, cool drinking water will also help to keep pigs comfortable in hot weather.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society and Jersey Cattle Society, production charts for which were compiled during the month of January, 1937 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORNS.				
MATURE COW (OVER 5 YEARS), STANDARD 350 LB.				
Nancy 14th of Springdale	J. Phillips, Sunnyview, Wondai	17,753·3	707·133	Lovely's Commodore of Burradale
Honey 8th of Sunnyside	P. Moore, Wooroolin	12,303·2	499·083	Bruce of Avonel
Kyabram Myrtle	A. H. E. Black, Kumbia	11,872·4	467·916	Ledger of Greyleigh
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD, 250 LB.				
Myrtle 2nd of Sunnyview	J. Phillips, Sunnyview, Wondai	13,213·8	523·014	Burradale Byron
Mabreen Honeycombe	V. Dunstan, Mabreen, Wolvi, Gympie	8,418·95	335·174	Numbawarra Headlight
Burradale Favourite 8th	A. H. E. Black, Kumbia	7,570·3	326·237	Burradale Banner
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD, 230 LB.				
Mabreen Nancy	V. Dunstan, Mabreen, Wolvi, Gympie	9,008·75	343·801	Numbawarra Headlight
Mabreen Gem	V. Dunstan, Mabreen, Wolvi, Gympie	8,062·3	297·861	Numbawarra Headlight
JERSEY.				
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD, 230 LB.				
Oxford Lady Daffodil	E. Burton and Sons, Wanora	5,231·05	314·13	Oxford Golden Lad
Kathleigh Model	D. Young, Kingaroy	5,429·3	310·045	Retford King's Thorn
Bellgarth Bonzanette II.	D. R. Hutton, Cunningham	4,863·5	274·169	Trecarne Renown II.
Kathleigh Royal Butterfly	J. Goostrey, Bald Knob, *via* Landsborough	5,963·9	320·999	Retford Royal Atavist
College Goldspray 3rd	Queensland Agricultural High School and College, Gatton	5,395·26	258·636	Burnside Defender

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.

Swamp Millet.

G.L. (Twin View, Elimbah)—

The specimen represents *Echinochloa Walteri*, sometimes called swamp millet, a native grass generally regarded as excellent fodder. It is very closely allied botanically to such well-known cultivated crops as Japanese millet and white panicum. Seed is not stocked by nurserymen, but the plant grows naturally along creek banks and in swampy places, generally in coastal Queensland, and once introduced usually spreads naturally in such localities.

Wild Sorghum.

G.H. (Mount Larcom)—

The specimen represents a species of wild sorghum, *Sorghum verticilliflorum*, a native of South Africa, but now widely naturalised in Queensland. It is rather a caney grass, and like other sorghums contains a prussic acid yielding glucoside. As a matter of fact, it contains more of the glucoside than most of the other sorghums growing in Queensland. On this account, if it is fed to stock, particularly to hungry stock, a certain amount of care should be exercised and the cattle prevented from gorging themselves on it. Preferably, it should be cut and allowed to wilt before feeding.

Mimosa.

D.D.L. (Kilcoy)—

The pods represent those of the mimosa bush, *Acacia farnesiana*. This is the same species that grows in Western Queensland. On the coast or near-coast, a few bushes are occasionally seen in paddocks or along creek banks. We are not sure if they are growing wild in such places, or if they have escaped from cultivation. The leaves are valuable sheep food, but occasionally we have heard of stock refusing to eat them. This, however, is rather unusual. The pods in a greener state than those you sent should be quite good fodder, particularly for sheep. We doubt if there will be enough leafage on the plant to worry about cattle.

Convolvulus. Ruellia.

R.C. (Mundubbera)—

1. The creeping plant or vine is *Convolvulus erubescens*, sometimes called the small convolvulus or morning glory. It is a very common plant throughout a good deal of Western Queensland and often seen right to the coast. As you mentioned, it is quite a good fodder, but these convolvulus vines sometimes cause impaction through their running, fibrous stems, particularly when old.
2. The smaller plant is *Ruellia australis*, a very pretty little native herb fairly common in many places for which we have not heard a distinctive local name. The generic one, Ruellia, however, is short enough for general usage.

Polygonum.

J.McK. (Boompa)—

The specimen is the oriental smart weed, *Polygonum orientale*. This is a fairly common plant in Queensland and usually grows in rather wet or badly drained situations. So far as we know, it has not previously come under suspicion as a poisonous plant, but smart weeds or species of Polygonum are known to cause trouble among stock. A symptom of poisoning by Polygonum is generally an inflammatory swelling of the ears, face, and eyelids. This affection is generally accompanied by itching, causing rubbing, shaking, and scratching of the head.

Yellow Plum.

S.E.S. (Cairns)—

We do not think there is any doubt that it is the Yellow Plum, *Ximenia americana*, a shrub that is fairly widely spread over the coasts of the Pacific in addition to North Queensland. In Queensland, it not only occurs right on the coast and sometimes a considerable distance inland. The fruits are edible but the leaves contain a prussic acid yielding glucoside and have been known to cause the death of goats that have browsed on it.

Carpet or Mat Grass.

W.D.B. (Yandina)—

(1) *Axonopus compressus*, carpet or mat grass, broad-leafed form.

(2) *Axonopus compressus*, carpet or mat grass, narrow-leafed form. These two forms are rather distinct as they occur in Queensland, but botanists generally regard them as the same species. As you know, there has been a good deal of controversy about carpet grass along the North Coast. There is no doubt that this grass is beneficial on second-class country, and in such places some dairymen and stock-raisers speak quite well of it. The common trouble with it is that it invades the ordinary paspalum country and other better class pastures, very much to their detriment. It is not a new grass along the North Coast, as it has, to our knowledge, been there for over twenty years. Probably the heavier stocking and thinning out of the paspalum pastures has given it a chance to invade them and increase.

(3) This specimen bore no seed heads, but we should say it was either an intermediate form between Nos. 1 and 2 or else simply a form of No. 1. If a few seed heads could be found we would much like to have them.

Blue Top.

P.McM. (Ballandean)—

The specimen is the blue top heliotrope, *Heliotropium anchusaefolium*, a native of Brazil and the Argentine that has now become rather a serious pest in parts of the Darling Downs particularly and in other parts of Queensland. It is not known to possess any poisonous properties. The plant was probably introduced originally as a garden plant and has been naturalised on the coastal lands for many years past, but on the coast it does not seem to be so aggressive as it is on the Darling Downs.

If you have a small patch the only plan is to keep it cut off below the ground level regularly so that the roots will eventually become exhausted by sending up numerous shoots. If, of course, they are allowed to get to a fair size the leaves nourish the roots and growth keeps on. The main object is to make the roots exhaust themselves by sending up new shoots and, as these appear, cutting them off. This means, of course, regular work on the plot about once a month. Any of the common weed sprays could be used, but with plants of this type they have to be applied several times before the roots exhaust themselves.

Wild Setaria.

H.P. (Stanthorpe)—

The specimen is *Setaria glauca*, pigeon grass or wild setaria. This grass is very widely spread over the warm temperate countries of the world and is fairly common in Queensland, mostly as a weed of cultivation or growing in rather damp places. It does not seem to invade the ordinary pasture to any extent. It is quite a good grass and is very closely allied to the cultivated setarias, giant setaria, dwarf setaria, panicum, Hungarian millet, &c.

"Early Spring" Grasses. Scented Top.

G.N.H. (Didcot)—

(1) *Eriochloa* sp. Species of Eriochloa are generally looked upon as excellent fodders. They are mostly known as early spring grasses, a not very appropriate name, for they are no earlier than many other grasses which come up with the early summer rains. The genus is at present under revision and we cannot give you a specific name for the particular one you send.

(2) *Capillipedium parviflorum*, scented top, a very common grass, particularly in much of the forest country of coastal and sub-coastal Queensland. It is generally regarded as quite a good cattle grass in such situations.

General Notes

Staff Changes and Appointments.

The appointment of the Officer in charge of Police at Goondiwindi as acting Inspector of Stock has been cancelled.

Mr. A. E. George, Court House, Ingham, has been appointed chairman of the Victoria and Macknade Local Sugar Cane Prices Boards, and also an agent of the Central Sugar Cane Prices Board for the purpose of making enquiries under section 5 (2A) of the Regulation of Sugar Cane Prices Acts in regard to sales and leases of assigned lands, vice Mr. C. B. Buxton, transferred.

Mr. R. A. Taylor, Inspector and Examiner under the Seeds, Fertilizers, Veterinary Medicines, Pest Destroyers, and Stock Foods Acts, has been appointed also an expert under the Pure Seeds Act, during the absence at any time of the Officer in Charge, Mr. F. B. Coleman.

Mr. R. W. Greville (Lane Cove, Sydney) has been appointed Assistant Veterinary Surgeon, Department of Agriculture and Stock.

Mr. R. J. F. T. Wust, Government Teacher at Poid, Moa Island, via Thursday Island, and Mr. G. A. Frusher, Government Teacher at Saibai Island, via Thursday Island, have been appointed honorary rangers under the Animals and Birds Acts and the Native Plants Protection Act.

Mr. D. O. James (Babinda) has been appointed canegrowers' representative on the Babinda Local Sugar Cane Prices Board, and Messrs. P. E. Nielsen (Septimus, Mirani) and T. F. Ross (Oakenden, Eton) have been appointed canegrowers' representatives on the North Eton Local Sugar Cane Prices Board.

Mr. F. Moore, Double Island road, Cook Highway, has been appointed an honorary ranger under the Animals and Birds Acts and the Native Plants Protection Act.

Mr. V. J. Anderson, Acting Clerk of Petty Sessions, Childers, has been appointed chairman of the Isis Local Sugar Cane Prices Board and an agent of the Central Sugar Cane Prices Board during the absence on leave of Mr. L. H. Roles.

Northern Pig Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts, amending the constitution of the Northern Pig Board in regard to the furnishing of information and returns by growers and covering any prosecutions for offences.

Tobacco Pure Seed District—Central Queensland.

An Order in Council has been issued under *"The Tobacco Industry Protection Act of* 1933" altering the boundaries of the Tobacco Pure Seed District in the Marmor, Bajool, Archer, and Nerimbera districts, by including therein the parishes of Bouldercombe, Gracemere, and Barmoya.

Barley Board.

An Order in Council has been approved under the Primary Producers' Organisation and Marketing Acts, amending the constitution of the Barley Board by declaring the class of persons who shall be deemed to be growers of barley and eligible to vote at any referendum or poll in connection with barley.

Formerly, a voter was a person who harvested barley during the preceding twelve months. The amendment provides that persons eligible to vote shall be those who at any time during the two years preceding the date of a referendum or poll—

- (*a*) delivered their barley to the Barley Board;
- (*b*) furnished to the Board a return in respect of barley planted by them during any of those years for delivery of the resultant grain to the Board; or
- (*c*) established to the Board's satisfaction that they have planted barley for delivery of the grain to the Board and have failed to obtain a marketable crop therefrom.

Atherton Tableland Maize Board.

An Order in Council has been issued in pursuance of the provisions of "*The Primary Producers Organisation and Marketing Acts,* 1926 *to* 1935," amending the constitution of the Atherton Tableland Maize Board in regard to the furnishing of information and returns by growers to the Board, and covering any prosecutions for offences.

Rural Topics

Banana Planting.

At this period of the year banana-growers are seriously considering their source of planting material, for the time is almost at hand when the very important operation of planting must be commenced.

Various opinions are put forward as to the best class of plants to use, and under certain conditions most of these opinions, if carried out, are capable of producing satisfactory results. The following is a brief description of each:—

Sucker—Should be selected from a vigorous, healthy stool, the actual sucker selected being about 18 inches high, and having a big, strong, clean corm of at least 6 inches in diameter.

Butt—Should be selected from a vigorous, healthy stool, and trimmed so as to allow not more than two eyes to come away. When trimmed a butt plant should measure about 7 inches in diameter and 6 inches deep.

Bit—Should be selected as in the case of the butt, and in reality is a suitable section of a selected butt.

When weather conditions run awry, and lack of rain makes banana-growing somewhat difficult, the butt plant should be easily a first choice on account of its resistance to the harder conditions.

Lantana country, burnt and grubbed, is ready to hole out and plant; scrub country, burnt, logged up if necessary, and holed out, is also ready to plant; but forest country needs digging up to a depth of at least 6 inches before holing and planting.

Planting 10 feet by 10 feet is to be recommended, and big holes are always an advantage; 15 inches square by 12 inches deep, or even larger, are the measurements suggested for the guidance of prospective planters.—J. H. FREEMAN, Senior Instructor in Fruit Culture.

Curdled or Cheesy Milk—Importance of Cooling.

Recently a sample of milk was examined at the Dairy Research Labratory, which had coagulated or curdled when only a few hours old. Through the co-operative action of microbes the curd had become flaky or lumpy, due to disturbance by rising bubbles. It was not appreciably sour, but had a cheesy odour, and the phenomenon was found to be due to an action resembling that of rennet (similar to the action of junket tablets in milk).

Milk which has been curdled by rennet generally turns cheesy, and also can be distinguished easily from sour milk by its appearance. Rennety milk usually curdles with separation of clean whey and a compact curd, whereas sour milk curdles uniformly throughout. This defect arises spasmodically, and may be attributable to unusual weather conditions, and to the lack of efficient cooling of the milk. The well-known phenomena of milk being specially liable to curdle in thundery weather does not seem to be ascribable to any other reason than the high temperatures which usually precede a thunderstorn.

This was one of those pecular cases in which the temperature had not been low enough for the development of favourable bacteria, but where higher temperatures had favoured the growth of undesirable types. If the temperatures had been low enough, the development of desirable microbes would have largely prevented the growth of the undesirable. Thence the importance of keeping the temperatures as low as possible, and the need for rapid cooling of milk. The quicker the animal heat is removed from the milk the less possibility there is of unfavourable changes taking place, due to microbes. As the warmer weather approaches, the need for cooling becomes more and more apparent. Therefore, it is necessary to see that the quality of the milk and cream is not graded down due to lack of a cooling system or to badly-cooled milk. Energy expended in endeavouring to cool milk supplies will be amply repaid by the choice quality cream produced.—L. E. NICHOLS, Dairy Research Laboratory.

Orchard Notes

APRIL.

THE COASTAL DISTRICTS.

IN the Orchard Notes for March the attention of citrus growers was called to the necessity of their taking the greatest possible care in the gathering, handling, sweating, grading, and packing of the coming crop of fruit, as the returns for the labour expended in the upkeep of their orchards will depend entirely on the condition in which the fruit reaches the market. Many growers fail to realise the very important fact that the success of fruitgrowing does not depend merely on the proper working and management of the orchard, so essential for the production of a good crop of high-class fruit, but that the manner in which the fruit is handled and placed on the market is of even greater importance. In no branch of fruit culture is this more evident than in the case of citrus fruits, as no fruit pays better for the extra care and attention necessary to enable it to be marketed in the best possible condition. Every season there is more or less loss in the consignments sent to the Southern markets, the percentage depending mainly on the weather conditions, the loss in a wet year being much heavier than that in a dry year.

A very large percentage of the loss is due to what is known as blue mould—a rotting of the fruit caused by a mould fungus—and this loss can be prevented, provided necessary precautions are taken. Although this matter was dealt with last month, it is of such vital importance to our citrus-growers that it is necessary to again refer to it.

In the first place, growers must clearly understand that blue mould cannot occur on perfect fruit, the skin of which is free from injury of any kind. The fungus causing blue mould can only obtain an entry into the fruit through an injury to the skin; it will thus be seen that the remedy is to take every possible care not to injure the skin of the fruit in any way.

Few growers realise how easily the skin of citrus fruits is injured, especially that of fruit grown under moist and humid conditions, when the skin is full of moisture and so tender that the least sign of rough handling causes serious injury. The cells of the skin are so brittle that they are easily broken, and when so broken a ready means of entry for the mould fungus is provided, and blue mould follows in due course.

The remedy for blue mould is in the hands of the grower, who must learn so to gather, handle, and transport the fruit from the orchard to the packing-shed that it does not receive the slightest injury, and further, that when it has reached the packing-shed it must be carefully placed in shallow bins or on trays and be exposed to the air for at least seven days, so that the surplus moisture in the skin may be removed, and the skin thus become toughened and less easily injured. This drying of the skin is known as ''sweating,'' and during the time the fruit is being sweated it should be kept under observation, and all fruit showing signs of blue mould or injury from fruit flies, sucking or boring insects, mechanical injury or bruising, should be removed.

In order to prevent injuring the skin when gathering, all fruit must be cut and not pulled. Gloves should be used to handle the fruit, and when cut it should be placed in padded baskets or other suitable receptacles. Any fruit that falls or is injured in any way should be rejected, as it is not fit to send to a distant market. At the same time, if the injury is only slight, it can be sent to a local market for quick sale.

For oversea and interstate markets only perfect fruit should be selected, and further, it must be graded for size, colour, and quality, and properly packed, only one grade of fruit being packed in a case. The cost of cases, freight, and marketing is now so high that only the best fruit will pay to export, and even the best fruit must be properly graded and packed in order to produce the best returns.

All orchards, vineyards, and plantations not thoroughly clean should receive immediate attention, for from now until the next rainy season the ground must be kept in a thorough state of tilth and free from weeds in order, firstly, to retain moisture in the soil, and, secondly, to enable birds, ants, and predacious insects to get at and destroy the pupæ of fruit flies and other pests harbouring in the soil.

Banana and pineapple plantations must be put into good order, and kept free from weed growth.

Land to be planted with trees should be got ready, as, if possible, it is always advisable to allow newly-cleared land time to sweeten before planting.

Farm Notes

APRIL.

FIELD.—Those areas already lying in fallow for subsequent sowing with wheat should be kept in good tilth, using field implements that have a stirring effect in preference to those which tend to reverse the surface soil. The surface should never be allowed to cake; consequently all showers must be followed by cultivation, as soon as conditions will permit of teams and implements working freely.

Early fodder crops, such as barley (skinless or Cape) and certain varieties of wheat may be sown during April. Growers of winter fodders will be well advised to study the article dealing with dairy fodder plots which appeared in February, 1922, Journal.

Potatoes should now be showing good growth, and must be kept free from all weed growths by means of the scuffler. If sufficiently advanced, and any doubt exists as to the prevalence of blight, advantage should be taken of fine weather to give a second spraying of Bordeaux mixture, a calm and somewhat cloudy day being chosen if possible for the spraying.

Where land has been previously well prepared, lucerne sowing should be carried out this month, and intending growers of this fodder will be well advised to ascertain the germinating qualities of seed submitted to them for purchase. The difference between a good and bad ''strike'' is often traceable to the poor class of seed sown.

Maize and cotton crops should now be in the harvesting stage, and, once matured, are better in the barn than the open paddock, where weevils and other insects are usually prevalent at this season of the year.

Root crops sown last month should now be making fair growth, and during the early period of such should be kept free from weeds, and where necessary thinned out. Sowings of mangels, swedes, field carrots, sugar-beet, and rape may still be made where conditions of moisture will permit.

As the sowing season is close at hand for certain varieties of wheat—i.e., those which require a fairly long period to develop in—every effort should be made to bring the seed-bed into the best possible tilth and to free it from foreign growths of all kinds. The grading of all seed-wheat is strongly recommended, and growers who favour certain varieties should adopt a system of seed selection from prolific strains with a view to the raising of larger quantities of pure typical grain for ultimately sowing in their larger fields.

Pickling of wheat to prevent smut (bunt) is necessary. Germination tests should be carried out prior to commencing seeding operations.

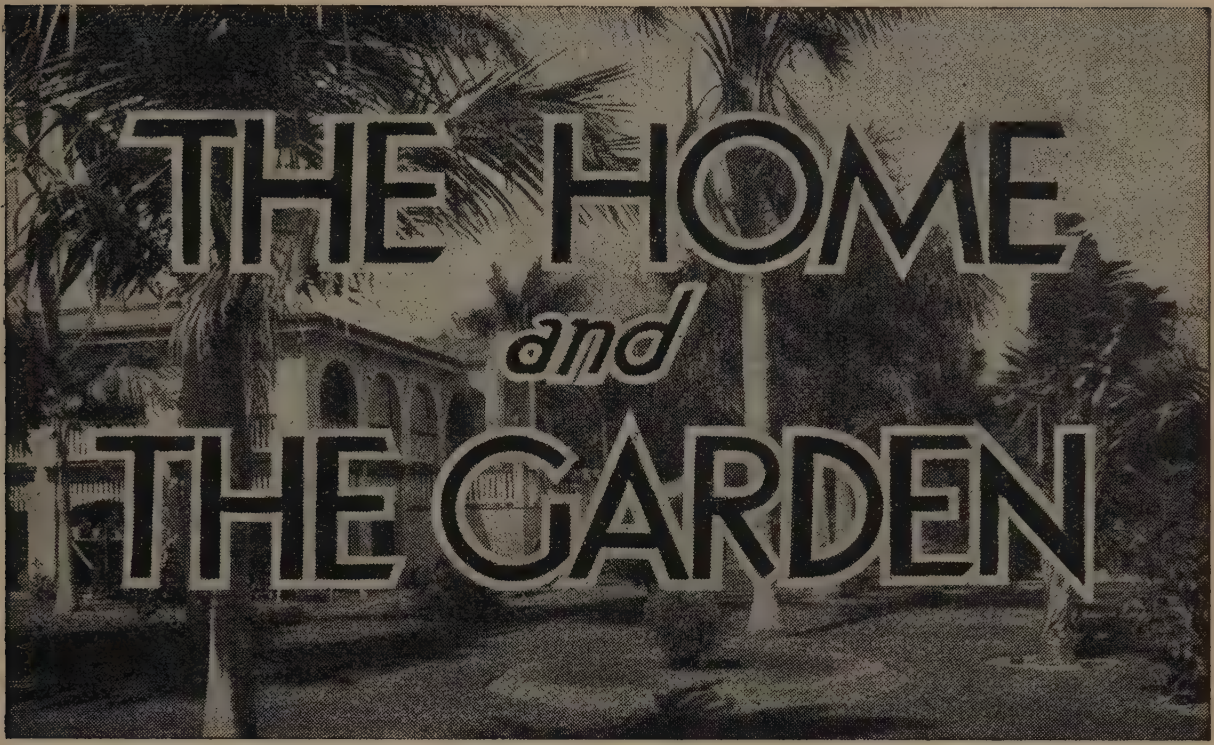
Sorghums which have matured and are not immediately required as green fodder should, wherever possible, be conserved as ensilage to provide for a reserve, to tide over the period when grasses and herbage are dry. Succulent fodder of this description is the best possible form of insurance against drought, and for maintaining dairy and other stock in thrifty condition.

SCOURS IN YOUNG PIGS.

Scouring due to nutritional anæmia often causes serious losses among suckers. The symptoms first noticed are marked paleness of the skin and failure to put on weight. Scouring generally develops three weeks from birth.

The trouble can readily be treated as follows:—

Dissolve ¾ oz. copper sulphate crystals and 4 oz. ferric sulphate in 1 pint of warm water. Stir in a pint of treacle. Smear the sow's udder lightly with the preparation twice daily. If the mixture irritates the sow—through small lesions in the udder—it may be painted in a strip along the bottom rail of the pen. If the timber is splintery, open an old motor tyre and nail it firmly to the rail. Paint the tyre. The young pigs readily acquire a taste for the material. Continue the treatment until weaning.



OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

BREAD—OLD AND NEW.

HOW many thousand years the grain of the wheat has been used by mankind for food we do not know. From the earliest times, the hard grain was ground by hand between two stones in small quantities as it was needed. Gradually this laborious hand grinding was replaced by simple machinery employing stone rollers worked at first by slave or animal labour, later by wind or water power, and quite recently by steam. From all these methods the product was the same; the whole grain was torn to pieces to make wholemeal flour. All wheaten bread was made from this wholemeal flour, and it was a first-class food.

White Bread.

Compared with wholemeal bread, white bread is a thing of yesterday. It dates from only seventy years back, when steel rollers were first introduced in the flour mills in America. These steel rollers produced a very fine white flour, from which the wheat embryo and the bran were sifted out. White flour can be kept for much longer than wholemeal flour, and this is a great convenience for commerce. Unfortunately, the valuable vitamins in the wheat grain are all in the parts of the grain sifted out. As their existence was unknown, no one knew of their absence.

The bread which has formed such a large part of our food was seriously altered in quality; it was still a nourishing food, but it was no longer a health-giving food. Those who lived largely on bread, either from necessity or choice, suffered from a partial want of vitamins. One consequence of this was the growth of an enormous trade in aperients of all sorts—a trade which is still flourishing.

Wholemeal Bread.

Lately there has been a revival in the use of wholemeal bread. There is, fortunately, still one stone-roller mill in Queensland, and this suffices to supply many bakers. This revival has been the result of many years' work by medical men and health reformers. Yet it does not seem to be realised that wholemeal bread is no new thing, but the good bread on which men have lived for scores of centuries; and the white bread, to which we have become so accustomed, is really a comparatively new thing, which after a short seventy years has been completely discredited as a basic diet.

The Newest Bread.

There are some people who do not like wholemeal bread, though there are only a very few with whom it does not agree. For them there is an alternative in a new sort of bread, which is very palatable. This bread is made of white flour with the addition of a fixed proportion of separately ground wheat embryo. It contains the valuable vitamins of the wheat grain in even larger proportion than does wholemeal bread, and this is an advantage, for in many kinds of foods besides bread there is a deficiency in these vitamins. Cerevite bread, as it is called, is being largely consumed locally.

Most trades are intensely conservative, and it is only natural that many millers and bakers are opposed to wholemeal and cerevite breads. This matters little, for the trade will supply what their customers want, and the enterprising tradesmen will reap the profit.

◆

IN THE FARM KITCHEN.

Eggs San Remo.

Take 6oz. shortcrust, 6 eggs, 1½ gills cheese sauce, paprika to taste.

Roll pastry out to quarter of an inch thickness on a floured pastry-board. Cut into rounds and line some tartlet tins with them. Prick the bottoms with a fork, and bake till crisp and pale golden in colour. Drop a lightly-poached or steamed egg into each. Cover each with a tablespoonful of cheese sauce. Dredge lightly with paprika. Serve with a green salad. Make the cheese sauce by heating a beaten egg-yolk in a double boiler, and by adding it gradually to a cupful of white sauce. Heat for one minute, then add 1 tablespoonful grated cheese, a nut of butter, and seasoning.

Eggs Lyonnaise.

Take 6 eggs, 2 onions, 1½ gills stock, 1 teaspoonful flour, 1oz. butter, pepper and salt to taste, 6 croutes fried bread.

Boil eggs till hard. Peel and mince the onions. Melt butter in a saucepan. Add flour and fry till brown, add onions and brown slightly. Add stock. Season to taste with salt and pepper, then simmer until creamy. Remove shells from eggs, then remove carefully the yolks from the whites. Mince egg-white and add to onion sauce. Bring to the boil. Heap croutes of bread with the sauce, place a yolk on top of each croute, and dab each yolk with a little of the sauce.

Water Lily Salad.

Take 6 hard-boiled eggs, 6 stuffed olives, 1 large lettuce, 1 teaspoonful chopped parsley, radishes, vinegar, olive oil, seasoning.

Boil the eggs for thirty minutes, chill in cold water, shell and cut lengthways, from small end nearly to the other, until six petals are formed. Take out yolks and beat them till smooth, with vinegar, oil, and seasoning to taste, and form into cone-shaped balls. Lay the white petals in the centre of a bed of heart of lettuce leaves, arranged on individual salad plates. Place a cone in centre of each lily, and sprinkle it lightly with finely-chopped parsley. Garnish with one or two tiny radishes and small olives to resemble buds, and mask with a little French dressing.

Spanish Omelette.

Take 3 eggs, 1½ tablespoonfuls cooked peas, 1½ tablespoonfuls tomato, 2 tablespoonfuls water, 1 tablespoonful pimento, ½ tablespoonful butter, pepper, salt, and paprika to taste.

Break the eggs into a basin. Beat slightly and add water. Season. Slice tomato and pimento finely. Stir them with the cooked peas into the beaten eggs. Melt butter in an omelette pan until smoking hot, but not more than slightly brown. Pour in the mixture. Cook quickly till slightly browned beneath and just set on top. Slip on to a hot dish, fold, and serve quickly, garnished with parsley.

Buttered Eggs.

Take 4 hard-boiled eggs, 1 cupful milk, 1 tablespoonful butter, pepper, 6 slices toast, 1½ tablespoonfuls flour, ½ teaspoonful salt, parsley.

Make a thin white sauce with the butter, flour, milk, and the seasonings. Remove the yolks from hard-boiled eggs. Chop the whites finely and add to the sauce. Butter the toast and cover four slices with sauce. Force two of the egg-yolks through a strainer on to the sauce. Garnish with remainder of toast cut into points, and the parsley.

Egg and Mushroom Pie.

Take ½lb. fresh mushrooms, 4 eggs, 2 tablespoonfuls butter, 2 tablespoonfuls breadcrumbs, salt, pepper, and paprika to taste.

Parboil the peeled and washed mushrooms, then saute in a saucepan with the butter and seasonings to taste for ten minutes. Pour into a shallow (au gratin) dish. Gently slip one egg after another on top. Season to taste. Sprinkle with fine breadcrumbs, dab with tiny pieces of butter, and bake until the eggs are just set.

Stuffed Eggs and Jellied Peas.

Take 3 eggs, 1½oz. butter, seasoning, 1 cupful cooked peas, aspic jelly, 1 lettuce, mayonnaise to moisten.

Boil eggs until hard. When cold, shell, cut in half, and remove yolks carefully. Mash these with the butter. Season to taste and moisten with the mayonnaise. Pile up in the egg-whites. If wanted more decorative, sieve the mixture and force mixture into the shells with a forcing pipe. Drain the peas. Divide between five small moulds and fill them up with aspic jelly. Leave till set. Turn out carefully. Serve eggs and moulds on a dish with lettuce leaves.

Aspic Jelly.

Take ½oz. gelatine, ¾ pint white stock, 1 small onion, 3 tablespoonfuls vinegar, bay-leaf, parsley, piece carrot, salt.

Moisten gelatine in a little of the stock and let stand for half an hour. Put the remainder of stock in a saucepan with other ingredients, and bring to the boil. Pour on the gelatine and stir till dissolved. Leave to cool. Strain through a very fine strainer. Before using, add a little browning to colour. Use as required.

Eggs and Anchovies.

Take 6 eggs, 1 teaspoonful minced eschalot, 2oz. butter, anchovies, toast, salt and pepper, 1 tablespoonful milk.

Beat up the eggs with pepper and salt to taste and the minced eschalot. Put the butter into a saucepan with the milk. As soon as the butter is melted, pour in the eggs and stir until it thickens. Prepare some hot buttered toast, spread the mixture over the toast, and put a fillet of anchovy on each piece.

Savoury Egg Toast.

Take 2 eggs, salt and pepper, 2 tablespoonfuls milk, 1oz. butter, anchovy paste, buttered toast.

Prepare the buttered toast in the usual way, and spread it thickly with anchovy paste, and keep it warm. Beat the eggs and mix them with the milk, adding seasoning to taste. Melt the butter in a saucepan, add the eggs, and stir these till they thicken and begin to set. Turn the egg mixture on to prepared toast, and serve.

Egg and Tomato.

Take 2 eggs, 1 gill tomato ketchup, ½oz. butter, ½ gill gravy, salt and pepper.

Place a spoonful of sauce and gravy and a small piece of butter in two ramekin cases. Put an egg in each and cover with tomato sauce and the remainder of the butter. Bake for seven or eight minutes or until set in a fairly hot oven.

Maltese Eggs.

Take a tablespoonful minced ham, 2oz. butter, 1oz. grated Parmesan cheese, 1 lemon, ½ pint white stock, 1 large tomato, pepper, salt, parsley, 6 eggs.

Mix together in a saucepan the ham, butter, cheese, lemon juice, salt, pepper, and parsley to taste, the stock, and one large tomato, sliced. Let this stew for twenty minutes, then strain it over a dish containing six hard-boiled eggs. Cover with breadcrumbs and some grated cheese. Bake in a very hot oven for just sufficient time to brown the surface, and serve in the same dish.

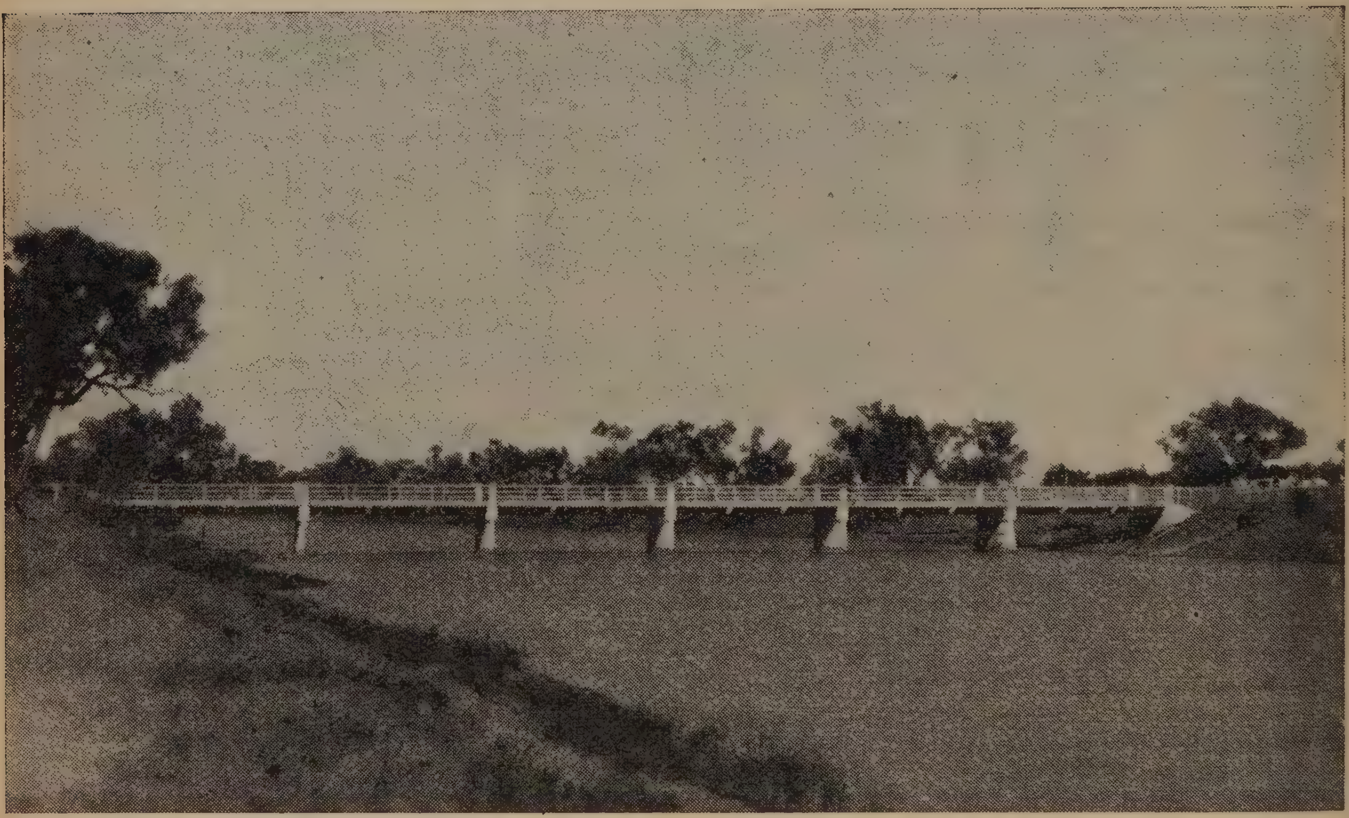


PLATE 125.

NEW BRIDGE OVER THE THOMPSON AT LONGREACH.—This steel and concrete structure has replaced the old wooden bridge, well known to old Westerners, on the Longreach-Winton Road.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF JANUARY IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1936 AND 1935, FOR COMPARISON.

Divisions and Stations.	AVERAGE RAINFALL.		TOTAL RAINFALL.	
	Jan.	No. of Years' Records.	Jan., 1937.	Jan., 1936.
North Coast.	In.		In.	In.
Atherton	11·99	36	5·87	8·35
Cairns	61·70	55	8·92	16·76
Cardwell	16·92	65	14·49	10·69
Cooktown	14·44	61	12·66	10·01
Herberton	9·67	51	4·32	7·20
Ingham	15·66	45	11·18	10·65
Innisfail	20·26	56	7·72	10·53
Mossman Mill	17·94	24	12·47	12·11
Townsville	10·98	66	5·52	7·66
Central Coast.				
Ayr	10·98	50	7·78	10·75
Bowen	10·00	66	1·57	8·15
Charters Towers	5·41	55	5·35	2·39
Mackay	14·10	66	2·81	8·78
Proserpine	15·83	34	5·06	18·81
St. Lawrence	9·29	66	5·20	10·14
South Coast.				
Biggenden	5·20	38	0·85	4·92
Bundaberg	8·64	54	3·61	4·77
Brisbane	6·44	85	1·57	5·73
Caboolture	7·57	50	2·10	5·12
Childers	7·38	42	2·73	4·48
Crohamhurst	12·26	44	2·11	6·01
Esk	5·74	50	1·17	6·44
Gayndah	4·61	66	1·89	5·78
Gympie	6·62	67	1·29	6·74
Kilkivan	5·54	58	0·62	6·14
Maryborough	7·10	66	1·45	2·86
Nambour	9·62	41	2·54	7·03
Nanango	46·3	55	1·43	3·05
Rockhampton	7·66	66	3·85	5·98
Woodford	7·77	50	1·33	5·76

Divisions and Stations.	AVERAGE RAINFALL.		TOTAL RAINFALL.	
	Jan.,	No. of Years' Records.	Jan., 1937.	Jan., 1936.
Central Highlands.	In.		In.	In.
Clermont	5·11	66	4·25	4·88
Gindie	3·71	38	..	4·78
Springsure	4·23	68	1·09	5·43
Darling Downs.				
Dalby	3·31	67	2·94	3·25
Emu Vale	3·22	41	2·01	4·47
Hermitage	3·23	31	0·91	3·57
Jimbour	3·48	49	2·33	2·29
Miles	3·63	52	3·56	1·61
Stanthorpe	3·58	64	7·58	2·88
Toowoomba	5·04	65	2·06	4·24
Warwick	3·56	72	2·57	4·44
Maranoa.				
Roma	3·08	63	1·86	2·18
State Farms, &c.				
Bungeworgorai	1·82	22	..	1·95
Gatton College	4·34	38	5·97	6·21
Kairi	9·87	21	..	3·82
Mackay Sugar Experiment Station	13·99	40	5·11	11·62

A. S. RICHARDS, Divisional Meteorologist.

THE IMPORTANCE OF THE SEPARATOR FLOAT.

Probably the most neglected part of the separator is the float, the function of which is to regulate the flow of milk into the bowl.

This means that it should be perfectly balanced, otherwise an irregular flow occurs and inefficient separation and fluctuation of tests result.

It has been frequently found that floats are badly dented, or leaking. To this condition is added the danger of throwing the float out of balance by amateur repairs. It has also been found that leaking floats have been repaired without first emptying them, which makes them heavier than designed.

Probably the most serious aspect of damaged floats is the fact that cracks and badly soldered joints provide ideal conditions for the growth of bacteria and in consequence milk passing over them becomes contaminated, resulting in many cases of cream being graded down.

Dairymen would be well advised to give consideration to this matter and when repairs are necessary to have them carried out by a competent tradesman, who should be advised of the importance of the work.

ASTRONOMICAL DATA FOR QUEENSLAND.

Times Computed by D. EGLINTON and A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

MOONRISE.

	March, 1937.		April. 1937.		Mar., 1937.	April. 1937.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	5·46	6·24	6·2	5·50	8·23	9·2
2	5·46	6·23	6·3	5·49	8·59	9·52
3	5·47	6·23	6·3	5·48	9·38	10·44
4	5·47	6·22	6·4	5·46	10·12	11·41
5	5·48	6·21	6·4	5·45	11·8	..
						a.m.
6	5·48	6·21	6·5	5·44	11·59	12·37
					a.m.	
7	5·49	6·20	6·5	5·43	..	1·35
8	5·49	6·19	6·6	5·42	12·54	2·36
9	5·50	6·18	6·6	5·41	1·53	3·38
10	5·50	6·16	6·7	5·40	2·52	4·40
11	5·51	6·15	6·7	5·39	3·54	5·49
12	5·51	6·14	6·8	5·38	4·55	6·56
13	5·52	6·12	6·8	5 37	5·58	8·6
14	5·52	6·11	6·9	5·36	7·1	9·14
15	5·53	6·10	6·9	5·35	8·8	10·19
16	5·54	6·8	6·10	5·34	9·15	11·17
						p.m.
17	5·54	6·7	6·10	5·34	10·22	12·10
18	5·55	6·6	6 11	5·33	11·27	12·53
					p.m.	
19	5·55	6·5	6·11	5·32	12·28	1·33
20	5·56	6·4	6·12	5·31	1·23	2·9
21	5·56	6·3	6·12	5·30	2·11	2·43
22	5·57	6·2	6·13	5·29	2·54	3·16
23	5·57	6·1	6·13	5·28	3·33	3·50
24	5·58	6·0	6·14	5·26	4·8	4·21
25	5·59	5·59	6·14	5·25	4·41	4·54
26	5·59	5·57	6·15	5·24	5·16	5·34
27	6·0	5·56	6·15	5·24	5·49	6·14
28	6·0	5·54	6·16	5·23	6·22	6.59
29	6·1	5·53	6·16	5·22	6·59	7·46
30	6·1	5·51	6·17	5·21	7·36	8·38
31	6·2	5·50			8·17	

5 Mar.	☽	Last Quarter	7 17 p.m.
13 ,,	●	New Moon	5 32 a.m.
19 ,,	☾	First Quarter	9 46 p.m.
27 ,,	○	Full Moon	9 12 a.m.

Apogee, 3rd March, at 6.0 p.m.
Perigee, 15th March, at 1.0 p.m.

Saturn, so inconspicuous to the naked eye, but the most wonderful of planets in the telescope, will on the 16th go down with the Sun and disappear from the evening sky. The rings which are now seen edgewise from the Earth will not be fully open until 1943.

On the 21st, at 11 a.m., the Sun will cross the celestial equator from south to north, and the Australian Autumnal Equinox will occur, the day and night being almost equal. The Sun will then rise due east and set due west, and it will be found useful to mark these points with reference to the horizon.

On the 25th Mercury will be in superior conjunction with the Sun—beyond the Sun from an observer on the Earth. It will on that day set with the Sun, after which it will night after night remain a little longer above the horizon after sunset, until it again reaches its greatest eastern elongation.

On the 27th Venus will apparently come to a standstill, and for about a month seem to move with retrograde motion.

Mercury rises at 4.18 a.m., 1 hr. 28 min. before the Sun, and sets at 5.32 p.m., 52 min. before it, on the 1st; on the 15th it will rise at 5.9 a.m., 44 min. before the Sun, and set at 5.50 p.m., 20 min. before it.

Venus rises at 9.15 a.m., 3 hr. 24 min. after the Sun, and sets at 8.16 p.m., 1 hr. 52 min. after it, on the 1st; on the 15th it rises at 8.54 a.m., 3 hr. 1 min. after the Sun, and sets at 7.41 p.m., 1 hr. 31 min. after it.

Mars rises at 10.13 p.m., and sets at 11.35 a.m. on the 1st; on the 15th it rises at 9.34 p.m., and sets at 11.3 a.m.

Jupiter rises at 1.54 a.m., and sets at 3.32 p.m. on the 1st; on the 15th it rises at 1.8 a.m., and sets at 2.49 p.m.

Saturn rises at 6.45 a.m., and sets at 7.11 p.m. on the 1st; on the 15th it rises at 5.44 a.m. and sets at 6.5 p.m.

The Southern Cross will come into view early in the evening in March. It will be at position III., as on the clock face, about 8 o'clock, and erect about 2 o'clock in the morning on the 1st March, an hour earlier in the middle of the month and two hours earlier at the end.

Phases of the Moon, Occultations, &c.

4 Apr.	☽	Last Quarter	1 53 p.m.
11 ,,	●	New Moon	3 10 p.m.
18 ,,	☾	First Quarter	6 34 a.m.
26 ,,	○	Full Moon	1 23 a.m.

Perigee, 12th April, at 6 p.m.
Apogee, 27th April, at 8 p.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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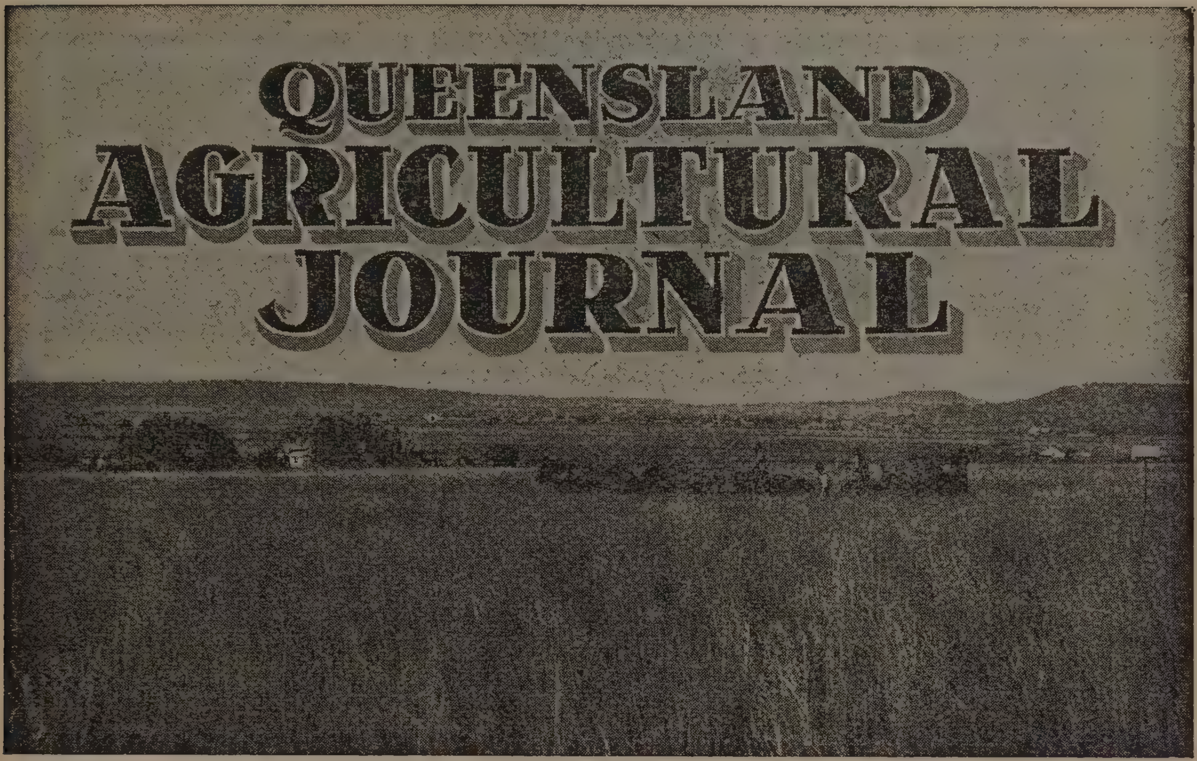

VOL. XLVII. 1 APRIL, 1937. PART 4

Event and Comment

Farming in the Far North.

IMPORTANT field problems were studied closely by the Minister for Agriculture and Stock (Mr. Frank W. Bulcock) during a recent visit to North Queensland, an official tour which extended as far as the new dairy lands on the Daintree River. Soil erosion, grassland improvement, the incidence of the white grub pest in paspalum pastures, and the possibility of extending the fat lamb scheme were among the major subjects of investigation. On his return, Mr. Bulcock remarked that some of the agricultural and pastoral problems of the Atherton Tableland were intricate and perplexing and he proposed to make a special effort to devise means of solving them. The work of pasture renovation would involve much research work, he said, and he proposed a plan of co-ordination in which the district agricultural staff and the Bureau of Tropical Agriculture at South Johnstone would assist. In the course of his tour among the farms Mr. Bulcock saw some crossbred lambs slaughtered. Two crosses were represented in the yarding—Dorset Horn-Merino and Romney Marsh-Merino. The Romney cross was of fair to average quality, while the Dorset cross produced lambs of superfine quality. The progress of the scheme for fattening inland-bred beef cattle on the coastal country also claimed the Minister's attention. The success of this scheme and that of lamb raising on the high tableland country would obviously become an important factor in the future development of the rich territory of the North.

The Case for Australia at the Sugar Conference.

ALTHOUGH the statistical position of world sugar is improving steadily, the surplus production problem continues as one of our major marketing anxieties. Present hopes are centred on increased world consumption, and the trend is certainly in that direction. Under recent legislation, agriculture in Britain is now assured apparently of a beet sugar industry that will, up to an agreed limit of output, continue to provide a profitable rotational crop, and that there will be no reversion to a state of dependence wholly by the Old Country on sugar imports. The Queensland cane farmer was, no doubt, relieved to learn last year that the limits fixed under the new law would not affect immediately the volume of their sugar exports to the British market. In fact, at the time it was claimed that the new measure was a material contribution to ordered control of the world sugar output. What will be the outcome of the international sugar conference now sitting in London is, however, within the realms of uncertainty. Cabled opinions have passed through the whole gamut of expression from gloomy pessimism to super-optimism.

So far as Australia is concerned, the existing preferential tariff on Empire sugar means to us about £2,500,000 a year—the annual value of our sugar shipments to Britain. The effects of its withdrawal—a distinct possibility—would be felt immediately. Reduced output and the consequent throwing of large numbers of people on to an already over-supplied labour market would be inevitable.

More than twenty countries are represented at the international conference now in session. The gathering is one of the most important in the history of the world sugar industry, and Australia is, therefore, very fortunate in its strong representation, which includes the Premier of Queensland, Mr. Forgan Smith.

Presenting the case for Australia, the Commonwealth Treasurer (Mr. R. G. Casey) emphasised that the world price of sugar had for an extended period remained uneconomic and disastrously low. Despite small preferences from the United Kingdom and Canada, the loss on Australian exports was particularly heavy, because Australia was the only country in the whole world producing cane sugar entirely by white labour, necessitating high wage-rates. Other countries in this matter had a tremendous advantage over Australia, which therefore would endeavour to support any fair and equitable plan to raise world prices to a reasonable level.

Continuing his exposition, Mr. Casey pointed out that directly and indirectly the sugar industry was responsible for 75 per cent. of Australia's present activities in the tropics. Therefore its maintenance and welfare were important. However, Australia's contribution to world stabilisation would require to be governed by the paramount necessity of avoiding any drastic curtailment in production by reduced exports. The Australian sugar industry had been gradually developed over seventy years in *bona fide* circumstances and in the face of many difficulties, and any drastic limitation in output would create graver problems in the parts of Australia concerned than in other countries enjoying a greater diversity of agriculture and more flexible social conditions and standards of living.

Mr. Casey urged the necessity of increasing consumption in the low consumption countries, which, if attained to even a limited extent, would solve the problem of over-production and produce a shortage in supplies. He pointed out that while New Zealand consumed 119 lb. per head, Australia 112·21 lb., and Britain 107·58 lb., Germany consumed only 52·23 lb., Czechoslovakia 55·10 lb., Hungary 23·80 lb., Poland 22.26 lb., Belgium 62·15 lb.

''Moreover, an arbitrary reduction in exports of sugar or of any other Australian commodity,'' continued Mr. Casey, ''is a matter for serious consideration by a country with large external financial obligations, unless a higher price is received for the reduced exports and there is a possibility of alternative compensatory employment. It is essential that the conference should devise a plan to prevent any international agreement being thwarted by non-signatory Powers.''

The British View.

MR. RAMSAY MacDONALD, in his inaugural speech, drew attention to the improvement in the statistical position, but pointed out that the world price was only remunerative to the cheapest producers. The fundamental object of the conference should be to assure stability. The United Kingdom, which was a large consumer, did not favour an increase in prices above a just economic level.

Mr. MacDonald suggested that countries not exporting on a free market should regulate production to maintain the free market at as high a figure as possible. Countries supplying a free market should regulate exports to keep supplies at a level appropriate to the possible demand. All countries should do what they could, if free market prices rose to an economic level, to adjust protective duties and subsidies to prevent internal prices from rising to a point that would check consumption and stimulating new production. A general agreement like that for tin and rubber was impossible. The conference must draw up rules applicable to each group of countries. The allocation of export quotas was not easy. He hoped that exporting countries would not seek quotas based on theoretical considerations, but would keep strictly within the limitations of the free market. Others might be asked to keep their internal production at an agreed maximum.

Mr. MacDonald suggested the appointment of a statistical committee and a small bureau to formulate proposals as the discussions proceeded.

The World Sugar Situation.

SUGAR circles are not without hope of a favourable outcome of the conference, to which the improved statistical position should contribute. World production for the year ending 31st August next is estimated at 30,770,000 tons, and consumption at 30,892,000 tons. It is expected that world stocks, normally 3,500,000 tons, will decline to around 75,000 tons.

The main problem of the conference will be the allocation of tonnage. A considerable difference of opinion exists in regard to the advisability of a restriction scheme based on output quotas. Some consider this would force up production costs to the disadvantage of British colonial producers, and would prefer a restriction of acreage with a view to fostering the most efficient producers.

The Grasshopper Outbreak in Queensland.

1934-35.

J. A. WEDDELL, Entomologist.

[*Continued from p. 259, Part III., Vol. XLVII.—March, 1937.*]

SECTION II.

LIFE HISTORY AND HABITS OF CHORTOICETES TERMINIFERA WALK. IN SOUTH-EASTERN QUEENSLAND.

Summary of Life-cycle Stages.

The species *C. terminifera* follows the developmental changes normal to members of the family Acridiidæ.

The eggs (Plate 126, figs. 1 and 2, and Plates 127 and 128) are laid in the earth in batches, each egg being approximately 5 millimetres long and 1 millimetre in diameter and light-brown in colour. The eggs normally fill the lower two-thirds of the egg hole. They are embedded in and covered by a frothy secretion from the parent insect, which hardens, giving a somewhat crystalline appearance when examined.

The stage immediately following the hatching of the egg has a very brief existence, and, because of its unusual structure, it is generally referred to as a pre-nymphal stage and termed the vermiform larva, and is not regarded as a true nymph (Plate 126, fif. 3). It is creamy white in colour, about ¼ inch in length, and it is quite helpless on emergence above ground. The emergence of this stage and its transformation to the active hopper is later outlined.

There are five nymphal or active hopper stages (Plate 126, figs. 4 and 5). The first is approximately ¼ inch in length, the measurements of the subsequent stages being largely determined by the availability of food. The general colour of the first hopper stage is grey to greyish-brown, but the later instars are brown with dark-brown markings; a percentage of individuals, however, develop gradually a general green colouration with brown or grey-brown markings. The wing-buds may be readily distinguished on instars III., IV., and V.

The adults (Plate 126, figs. 6 and 7) are of two main colour types with grading intermediate forms. The brown insects were usually by far the more numerous; a few green variants could, however, be easily distinguished, while in some swarms the green forms were almost in the majority. Swarms seen at Tara and Yarranlea in November, 1934, included a relatively high percentage of green individuals, while at Goondiwindi at the same time the swarms were predominantly brown.

Adults varied greatly in size, measurements from the front of the head to the tip of the folded wing varying from 0.95 inch to 1.65 inch—*i.e.*, from 24 millimetres to 40.5 millimetres.

Egg-beds.

Oviposition was observed in a variety of different situations and soil types during the course of the outbreak. In certain instances heavy laying had occurred in hard-beaten ground completely bare of all vegetation, an outstanding example being earth roads in the Inglewood township. Areas of claypan were also used for egg-beds. These claypans

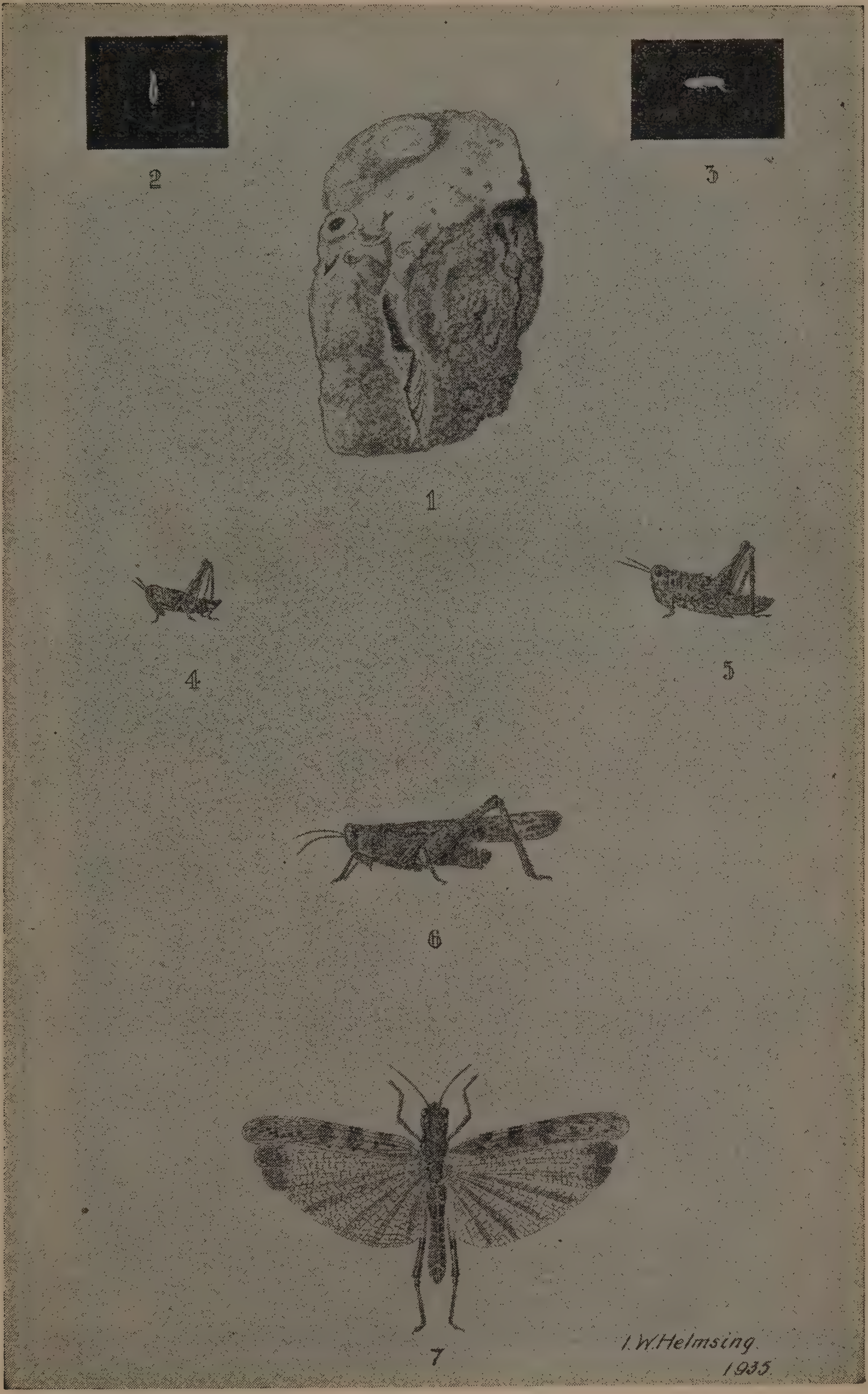

Plate 126.

Fig. 1.—Fragment of soil showing "egg pods" and eggs *in situ*. Fig. 2.—Egg. Fig. 3.—Newly emerged hopper. Fig. 4.—Later stage hopper. Fig. 5.—Pre-adult hopper. Fig. 6.—Adult male (lateral view). Fig. 7.—Adult male (dorsal view). All figures natural size.

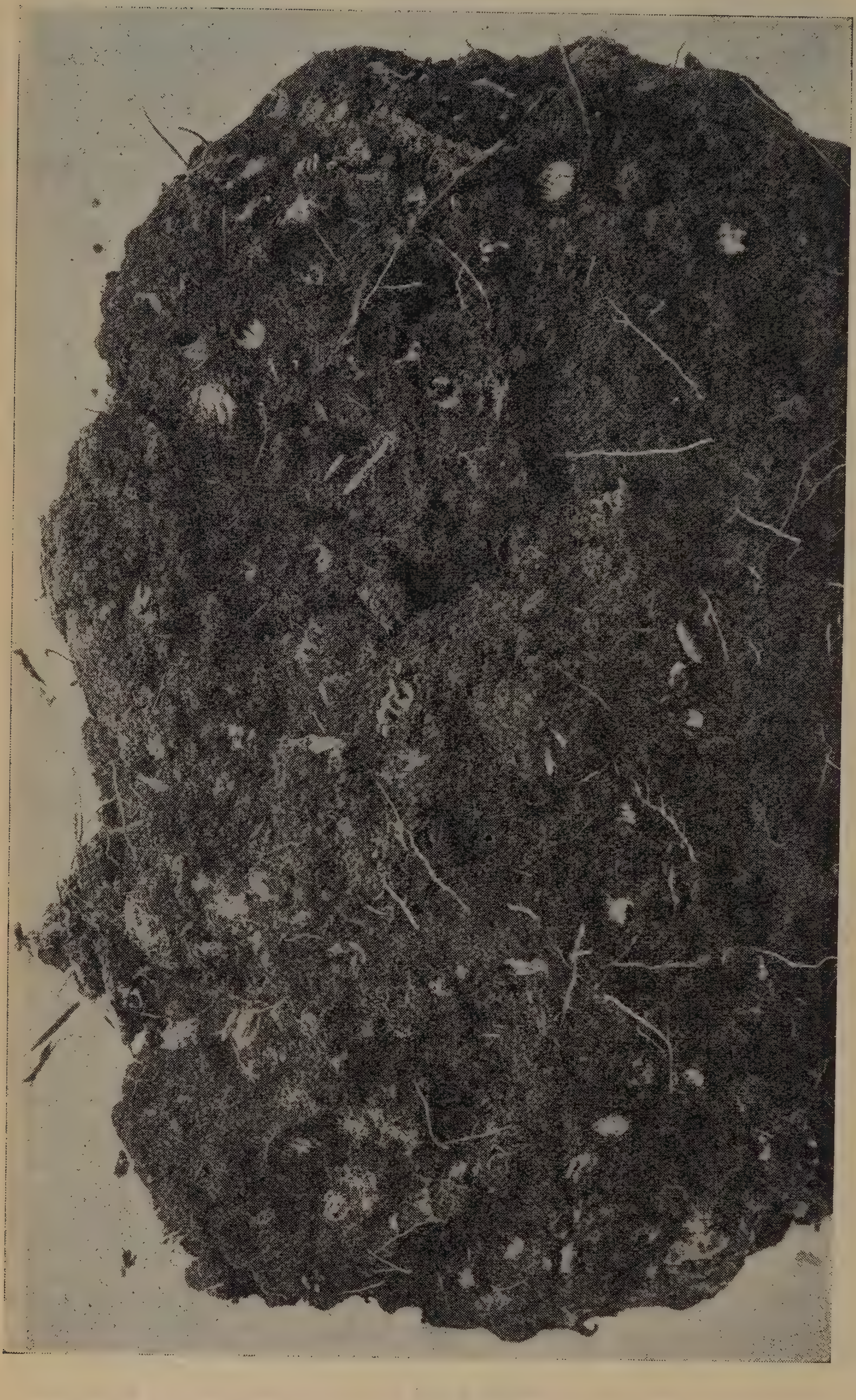

Plate 127.

The under side of a slab of earth removed from egg-bed; note the broken egg pods with eggs *in situ*.

were usually very hard and compact. The more usual sites, however, were those consisting of slightly rising ground, sparsely grassed, showing small areas of bare ground between the tufts of grass and herbage. Hard sandy ridges were also favoured.

A definite hardness of the ground was not by any means a necessary quality of an egg-bed. A surface crust such as that produced by the slight compacting that follows rain was amply sufficient to provide the necessary foothold for the gravid female. Heavy laying was observed in partially cultivated paddocks, between rows of maize, in the sandy loam of a tobacco farm, the ground being almost ready for planting, and in a sandy area carrying a very sparse grass cover. In all cases a slight crust had formed on the surface prior to egg-laying. An example of oviposition on a sandy loam is illustrated by Plate 129, which also shows the effect of heavy rain on the egg-bed. The rain washed the surface soil away and disclosed the egg holes. During oviposition egg-beds could be readily located owing to the swarming females. Further, a percentage of the insects usually became jammed in the soil, and their dead bodies then marked the site for a few days.

Plate 128.
Vertical section of soil showing egg pod, natural size.

As a general rule, however, the actual egg holes were rather difficult to locate prior to hopper emergence, even though egg-laying had been observed. However, when the insects emerge, the small circular earthen cap is pushed from the hole and numbers of the tiny caps may readily be found.

Egg-beds of various dimensions were seen. Those in the Kooroongarra area were usually smaller—rarely exceeding an acre in extent—than those in the Goondiwindi and Inglewood districts, where egg-beds of several acres were not uncommon. Egg holes varied in density up to about 120 per square foot, while eggs in the egg pods ranged from 18 up to 57, the latter being found in an egg-bed in sandy soil. The general average ranged from 30 to 40 eggs per egg pod.

Exceptional behaviour on the part of the gravid female was observed in an egg-bed at Goondiwindi, where a large number of females laid their eggs on fence posts and rails and on the trunks and limbs of trees to a height of 15 feet from the ground. The eggs were all overlaid by a mass of froth, as though they had been normally deposited. Needless to say, the eggs so laid quickly dried out and no hoppers emerged. (Plate 130.)

Emergence of Hoppers.

The emergence of the hoppers from an egg-bed is very interesting. Apparently the eggs in an egg pod hatch almost simultaneously, and the combined pressure of the young insects serves to dislodge the cap of the hole. The insects then commence to ooze (there is no better word) on to the surface. The first-stage or vermiform larva is white in colour, very weak, helpless, and fragile. It is only about one-quarter of an inch in length, but its slender, soft, white legs are quite incapable of supporting its weight. As a result, the insect lies helplessly on the surface. Within periods varying from half an hour to five minutes the pale skin of this first stage splits dorsally and is shed, the moulted skin being finally pushed away from the hind tarsi. Almost simultaneously with the shedding of the skin the insect springs into activity. It stands alert with the jumping legs braced for use. The colouration of the chitin soon becomes evident, and within a few seconds the tiny insect is leaping away.

Plate 129.
Egg holes disclosed in sandy soil, following heavy washing by rain.

Habits of the Hoppers.

Hoppers were first observed at Kooroongarra in mid-September, 1934. The days then were just pleasantly warm, with cold nights. Newly hatched swarms were very compact, while further emergences daily increased the insect population. The young hopper swarms remained as compact masses and moved bodily, perhaps only a few feet per day, the movements being, for a period, at least, in no particular direction. The food requirements of these young hoppers appeared to be very slight, but they did feed, particularly on the succulent foliage of trefoils or burr clovers, two species—*Medicago denticulata* Willd. and *M. minima* Lam.—being very common on the Darling Downs. The somewhat haphazard movements of the swarms usually brought them, in the course of a few days, to slight depressions such as creek banks, melon holes, and so on, where ample supplies of succulent clover were available.

About a fortnight after emergence the hoppers changed their habit and something in the nature of a mass migration commenced. The direction of the migration appeared to be influenced solely by chance. A definite movement in a particular direction began and a heavy massing of individuals on the leading ''face'' was evident, the main swarm following behind. In the absence of suitable quantities of food, the insects moved forward fairly quickly, but when good pasturage was available the rate slackened noticeably and the front line became dense, sometimes over a width of 1 to 3 feet. Forward movement then continued day after day in the direction of the succulent feed. As a result, the appearance of a moving swarm attacking an area of young wheat was quite spectacular, resembling from a distance the daily advance of an irresistible tide.

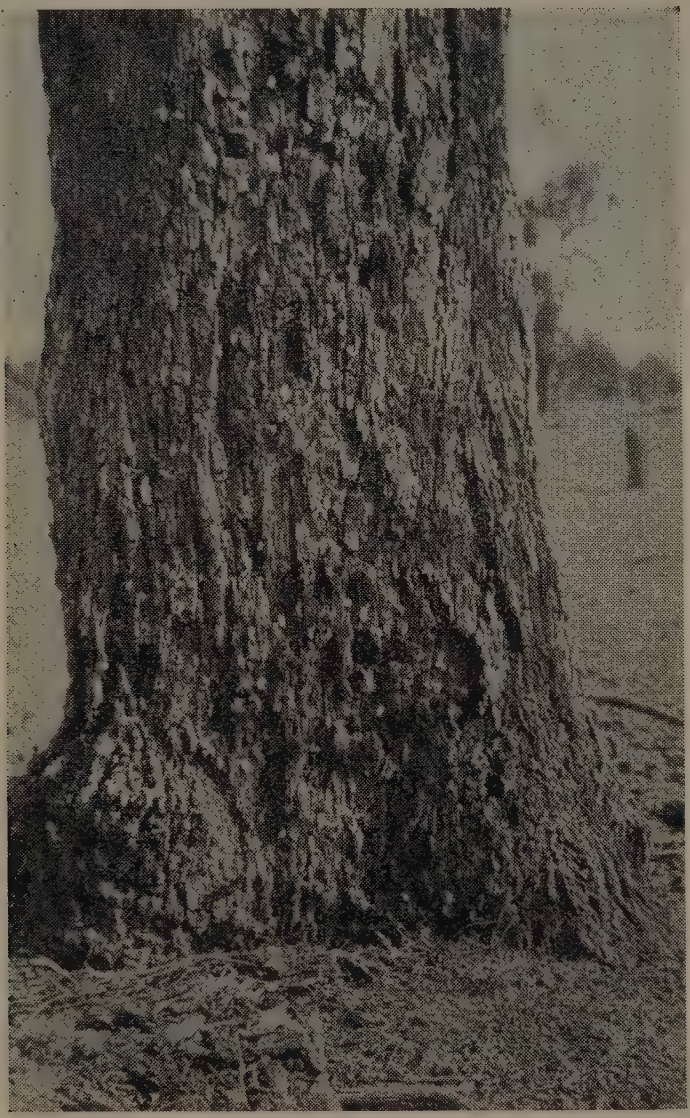

Plate 130.

An extraordinary oviposition site. Note the whitish egg masses on the tree trunk.

On clover the young hoppers nibbled the leaves and older hoppers chewed also the young stalks. On tall pasture grasses and grain crops the flag was eaten, but where the grain crop was young and the swarms dense very little of the plant remained when the swarm leaders had passed on.

Plate 131.
Young hoppers clustered as a dark mass on the western side of a log at 5 p.m.

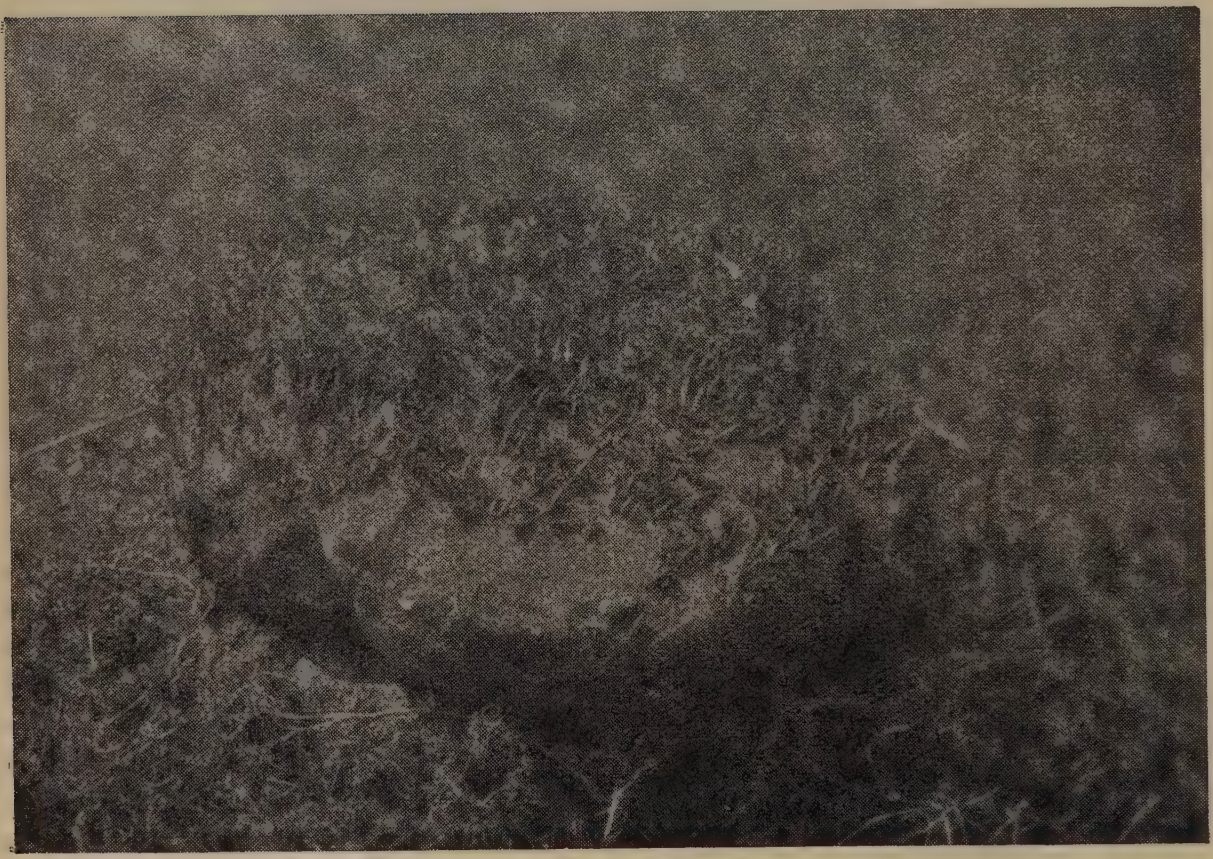

Plate 132.
Young hoppers clustered on a stone.

The reactions of hoppers to various stimuli are comparatively well known, but some points noticed seem worthy of mention. In the morning, up to about 8 a.m., the insects were quite sluggish and had not then abandoned their "sleeping" quarters. With the rising temperature, they became more active and were very easily disturbed. When walking through a swarm, the insects scattered from the line of advance, closing in again behind immediately afterwards. In bright sunlight they were exceedingly sensitive to any sudden movement. Thus, if one stood stationary for a short period, a sudden gesture was sufficient to stimulate the hoppers within a radius of several feet into intense activity, from which they gradually subsided.

As the shadows lengthened in the afternoon there was a general movement up the stalks of weeds, herbage, grass tufts, trunks of trees, logs, fencing, stones—in fact, anything that could be climbed, preferably, it seemed, to a height of about 18 inches above the ground. All such material within the area occupied by a swarm thus assumed a dark-brown to blackish appearance, due to the density of the hoppers (Plates 131 and 132).

The gregarious instinct was very evident, particularly among the young hoppers. The swarms of newly hatched hoppers were relatively small in the Kooroongarra district. The population density was, however, fairly high. One sampling yielded approximately fifteen insects per square inch throughout a swarm measuring approximately 33 yards by 17 yards—a total population of about 10,000,000 individuals. Needless to say, as the insects grew in size and became capable of a wider range of movement, these swarms spread and frequently occupied areas measurable in acres.

An avoidance of shade during the day was a noticeable characteristic of the spring generation (Plate 133). Practically all hopper movement in a swarm ceased during periods of cloud, and the margins of the swarm became noticeably blurred. Immediately the sun reappeared the line became distinct again and the insects moved forward. The next generation, bred under summer conditions, behaved rather differently. The hoppers became quiescent about midday and sought the shade, presumably owing to the higher temperatures.

As the feeding rate is apparently linked with general activity, it is not surprising that, whereas the spring generation fed during the middle of the day, the summer generation spent the midday hours in a state of comparative quiescence. Feeding started earlier in the morning and continued later in the afternoon. This had an important bearing on the selection of times for laying baits as a control measure.

Habits of Adults.

Adults migrated in fairly open or dispersed formation, each wave spreading over a wide area. Some travelled at heights up to 300 feet, but the majority of the population flew only 20 or 30 feet above the ground. Timber usually diverted or stopped the swarms, but sometimes the grasshoppers flew up and over lines of trees. Migration, however, usually took place over open or cleared country. Passing through townships, the adults mainly followed the roads. It was very noticeable that the main migration into the Inglewood district in November, 1934, was from south-west to north-east, following fairly well the improved properties and the cleared channels represented by the McIntyre Brook, the railway, and the main road, which lay more or less parallel in that direction. Migration along cleared fence lines and firebreaks in timbered country was also observed.

Plate 133.

Portion of swarm of young hoppers migrating past a newly-planted tree. Note the definite avoidance of the shadow cast on the ground by the roll of hessian.

Adults were seen flying through open timber, but they did not enter dense timber. One dense swarm was found margining a belt of trees, and only two or three paces into the timber there was complete freedom from grasshoppers. Egg-beds were frequently found adjacent to timber areas following migratory flights in that direction.

Swarms were relatively dense when mating occurred, while for oviposition the females congregated so closely together that sometimes the ground was almost obliterated from view.

Peculiar Feeding Habits.

One station-owner attempted to protect his vegetable patch from invading grasshoppers by covering the beds with hessian. Holes were subsequently eaten through this hessian cover.

A patterned linen cloth was washed and hung in the open to dry while a flight was in progress. A number of insects settled on the wet cloth and in a short time it was completely ruined. The cloth was of white linen patterned in blue and black, and in feeding on it the insects exhibited what almost amounted to a colour preference in that the darker portions were predominantly the worst affected.

Number of Generations in South-eastern Queensland.

Unfortunately, it was not possible to watch the insects breeding, in the districts affected, for a complete year. Nevertheless, there can be no doubt that not less than three complete generations are possible in South-eastern Queensland in a single year. The following records for 1934-35 can be explained only on this basis:—

TABLE 3.

Date.	Record.	Egg Period.	Larval Period.	Generation.
1934. April–May	Adults oviposited	Approx. 4 months	..	..
Early September	Nymphs emerged			
Early September	Nymphs emerged	..	Approx. 7–8 weeks	I.
Late October	Adults on the wing			
3rd November	Adults oviposited	19–21 days	..	..
22nd November	Nymphs emerged			
22nd November	Nymphs emerged	..	Approx. 6 weeks	II.
1935. 4th January	Adults on the wing			

Assuming that adults on the wing in January laid eggs, their progeny—the third generation—would develop in nine to eleven weeks, yielding adults capable of oviposition early in April, thus returning to the period with which the table commenced.

Natural Enemies.

At intervals several species of birds, including ibis, starlings, plain turkeys, and crows, fed on the hoppers. The ibis appeared the most important, particularly in the Kooroongarra locality. Several large flocks visited the swarms day after day and fed actively. Quite often the presence of the birds facilitated the location of hopper swarms at a distance.

Birds are, no doubt, useful in destroying noxious insects, but in the face of an epidemic occurrence they are quite incapable of effectively reducing the pest population.

By far the most important insect enemies of the grasshoppers were the Scelionid egg parasites. Two species—*Scelio chortoicetes* Frogg. and *S. fulgidus* Crawf.—were collected. Occasional egg pods at Kooroongarra in September were parasitised to the extent of 60 per cent. to 80 per cent., but these were apparently exceptional, for the total parasitism in the egg-beds, as judged by the subsequent hopper emergence, could not have been considerable. At Goondiwindi up to thirty adult Scelionids per square yard were found on certain egg-beds during the spring. Again, in spite of this, very heavy hatchings of hoppers occurred.

These Scelios, however, accomplished outstanding work on the eggs laid in November. One example may be quoted. Female grasshoppers oviposited on the same site for the two successive generations. From eggs laid in the autumn the normal heavy hatch of hoppers occurred in the spring, and at the time of emergence a number of Scelionids were seen. Heavy oviposition recurred in November, and parasitism was so effective that only a few hoppers emerged. Scelionids were exceedingly active and numerous over the whole egg-bed of some acres. During November the Scelionid wasps were readily found wherever heavy oviposition occurred.

Two species of Tachinidæ were bred from the plague grasshopper—*Locustivora pachytyli* (Skuse) and *Helicobia australis* (J. and T.)—larvæ being found in both immature and adult grasshoppers from Goondiwindi. Among some swarms the percentage of parasitism appeared to be high. The degree to which this form of parasitism subsequently impaired reproduction was not investigated, but otherwise the effect of the parasitism was not particularly marked. Occasional parasitised individuals were certainly sluggish, but many apparently normal insects contained well-grown maggots.

A number of swarms of both adult grasshoppers and nymphs were infested by red mites, and in one instance the bulk of the population was attacked. The insects so infested were definitely sluggish.

[TO BE CONTINUED.]

CODLING MOTH CONTROL.

In the February issue of this journal a brief note on codling moth control was published, although the advice it contained was obviously out of season. The note was originally prepared for and published in another departmental publication—*The Weekly News Bulletin*—for use during the week ended 17th October last, when it had a seasonal value.

Although unseasonable at the time of publication in the *Queensland Agricultural Journal*, the advice the note conveyed might well be kept in mind as applicable next spring. A further reminder will, of course, be published before then.

Queensland Weeds.

JOHNSON GRASS AND WILD SORGHUM.

C. T. WHITE, Government Botanist.

Johnson Grass (*Sorghum halepense*).

DESCRIPTION.—A robust, perennial grass, mostly 3-5 feet high, with numerous well-developed white underground stems or runners; each runner with numerous short internodes and capable when cut into small pieces of developing into new plants. Leaf-blades 12 to 15 inches long, mostly under ½ inch wide; uppermost leaf-sheaths about 6 inches long, the lower ones successively shorter; ligule silky-hairy. Inflorescence (seed-head) 9-12 inches long and almost 8 inches across. Spikelets of two sorts, the smaller, narrower ones male or sterile, the others and larger, female or fertile. Fertile spikelets scarcely ¼ inch long, densely covered with silky hairs, awn brown, bent and twisted, over half an inch long, soon falling off.

Distribution.—A native of the Mediterranean region, now naturalised in most warm temperate and sub-tropical countries.

Botanical Name.—*Sorghum,* probably from Sorghi, an Indian name for *Sorghum vulgare; halepense,* Latin, meaning a native of Aleppo, Northern Syria.

Common Name.—The origin of the name Johnson Grass is explained in the following way by Ada E. Georgia in ''A Manual of Weeds,'' New York, 1914:—''About 1830 there came to Governor Means, of South Carolina, a message from the Sultan of Turkey, requesting that an instructor in the art of raising cotton be sent to the Ottoman Empire. Two or three years later, when the instructor returned, he brought with him the seeds of a number of plants that seemed to him to be of economic value, and among them was this grass. An Alabama planter, Colonel William Johnson, while on a visit to South Carolina, became interested in the new plant, obtained a quantity of seed, and raised it extensively on his plantation in the fertile bottom lands of the Alabama River.''

Properties.—Like most of the Sorghums, Johnson Grass contains a prussic acid-yielding glucoside. The glucoside is most developed in the young stages, particularly second growth, and its use as a fodder unless cut and allowed to wilt for a short time is always attended with a certain amount of risk.

Eradication.—As in all plants with an underground food storage system, all attempts at eradication should be aimed at keeping down the leaf growth by cutting or mowing, as the vigour of the underground runners depends on the leaves. Pigs are especially fond of the white, succulent, underground parts of Johnson Grass, and are useful in keeping the pest in check, but as the glucoside is present in these as well as the green leaves and stem there is always a certain amount of risk in allowing pigs to feed on them.

Botanical Reference.—*Sorghum halepense* (L.), Persoon Synopsis Plantarum I., 101 (1805).

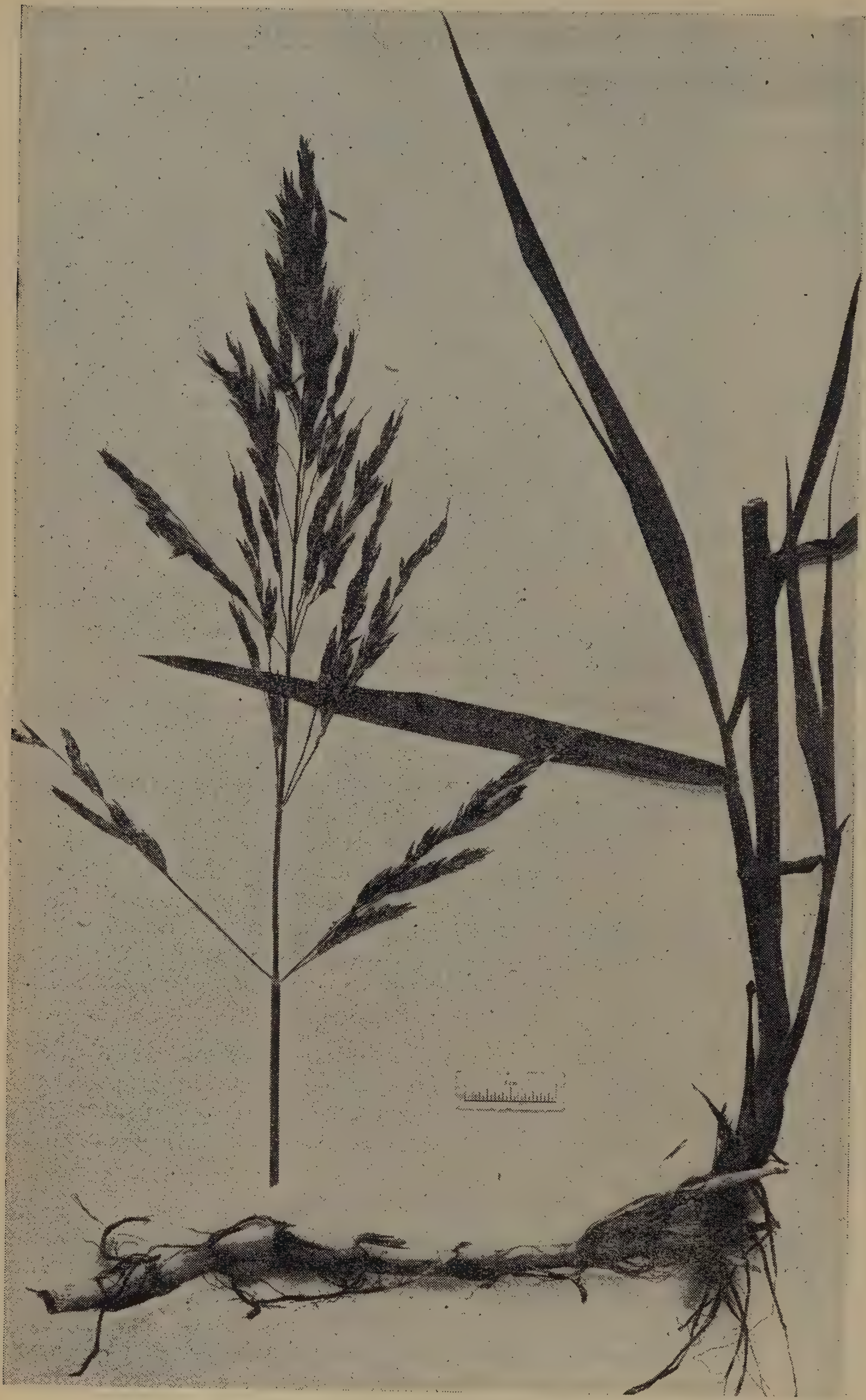

Plate 134.
Johnson Grass (*Sorghum halepense*).

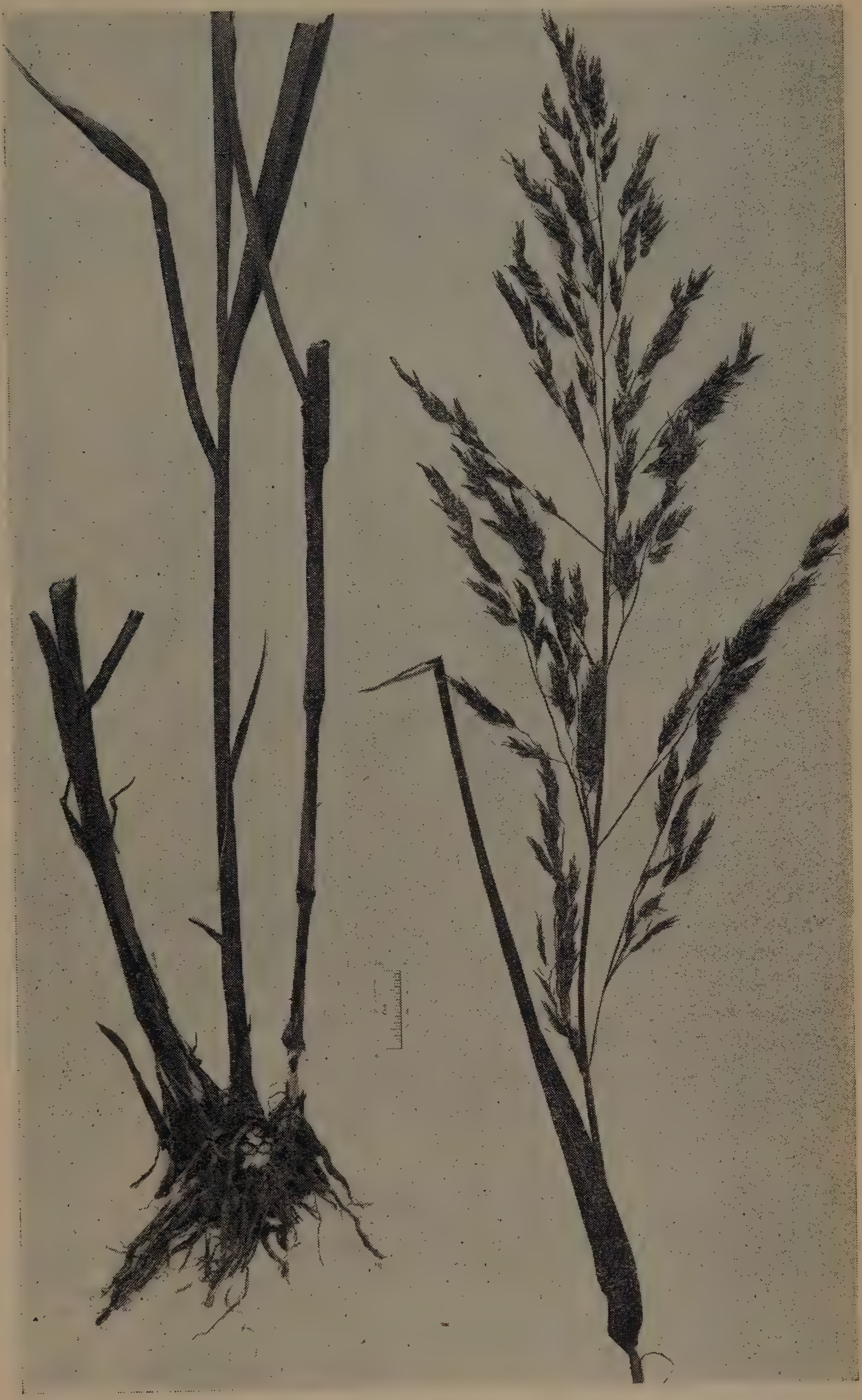

Plate 135.
Wild Sorghum (*Sorghum verticilliflorum*).

Wild Sorghum (*Sorghum verticilliflorum*).

Description.—A tall, robust perennial grass, 6-8 feet high or more, the leaves and stems often stained a purplish red by bacterial infection; not producing white, underground runners as in Johnson Grass, but perennial through buds developed at the base of the stems. Leaf-blades 9-18 inches long, $\frac{1}{2}$-$\frac{3}{4}$ inch broad, uppermost leaf-sheaths about 1 foot long, lower ones successively shorter; ligule silky-hairy. Inflorescence (seed-head), 12-18 inches long and about 12 inches across. Spikelets of two sorts, the smaller, narrower ones males or sterile, the larger, plumper ones female or fertile. Fertile spikelets $\frac{1}{4}$ inch long, covered with brown, silky hairs; awn brown, bent and twisted, $\frac{1}{2}$ inch or more long.

Distribution.—A native of Africa, where it has a wide range through tropical Africa to Natal. It is also found in Madagascar, the Seychelles, and the Mascarenes (the Mauritius Group of Islands). It is now naturalised in many warm countries. It has been established in Queensland for many years, and is much more abundant than *Sorghum helepense* (Johnson Grass), with which in the past it has been confused.

Botanical Name.—*Sorghum* (see under Johnson Grass); *verticilliflorum* from the Latin *verticillus,* the whirl of a spindle, and *flos, floris* a flower, in reference to the lower branches of the panicle or seed head being arranged in whorls.

Common Name.—Usually confused with Johnson Grass, but is a much more robust grass without underground runners. Wild Sorghum is, perhaps, the most commonly applied vernacular.

Properties.—The grass, according to tests carried out at the Agricultural Chemist's Laboratory (Brisbane) is one of the strongest cyanogenetic (prussic acid yielding) species, and its use as a fodder is therefore always attended with a certain amount of risk.

Eradication.—Unlike Johnson Grass, this species does not possess rhizomes, which have the power of growing from small underground pieces into new plants. It is not a particularly aggressive grass in cultivation areas, and calls for no special methods of eradication. It is very common round cultivation headlands, along railway embankments, etc.

Botanical Reference.—*Sorghum verticilliflorum,* O. Stapf. in Flora of Tropical Africa, Vol. IX., p. 116. (1917.) *Andropogon verticilliflorus,* Steudel Synopsis Plantarum Glumacearium 1, 393. (1854.)

TALKS ON ECONOMICS.

How did you vote on the Marketing Referendum? Why did you? Anyway, some people thought it was the most puzzling question that has ever been put before Australian electors. Certainly it was difficult to come to a conclusion on the matter without some knowledge of general Australian economics. Some simple, clear talks on various problems of Australian economics would be worth while reading. And any of our readers may get talks like this, simply set out and clearly typewritten. Write to-day to the Director of the Department of Tutorial Classes, corner Edward and Ann streets, Brisbane, who has some excellent talks available on Australian economics and economic geography. While writing ask for a list of all the subjects on which typewritten talks are available. The fee for a series of twenty-one lectures is only 8s. 6d., and for that fee you may also borrow books on the particular subject of the talks.

Review of Results from Fertility Trials in North Queensland.*

H. W. KERR.

Introduction.

IN 1929 the Bureau of Sugar Experiment Stations instituted the farm fertility trial project. To date, we have the results of seven years' effort, and it would appear opportune to review these results, for the purpose of extracting any general conclusions which appear warranted, and to indicate in which directions our future efforts should be concentrated.

It is recognised that the results obtained from an experimental area on one farm are specific for that area alone; but at the same time, when we have accumulated similar evidence from a series of such trials, on areas of similar soil type, we are justified in generalising our advice for the soil type as a whole. After all, our recommendations are based on but three classes of mixed fertilizer, which are, at the present time, adequate for our needs; as we cannot in the present state of our knowledge, draw finer distinctions between fertilizers of similar composition, or even designate to the nearest 50lbs. the quantity of fertilizer per acre which should be applied from year to year, no further refinement is demanded. We must remember, also, that the quantity of fertilizer which a farmer purchases is often governed not only by the needs of his land, but by the length of his purse.

Soil Types.

Our soil survey officer has provided us with maps of the Northern cane soils, and has classified them largely on the basis of their origin and mode of formation, into a number of major types, with minor variants. The major types are:—

(1) Granitic alluvials,
(2) Granitic residuals (usually sandy and gravelly loams),
(3) Schist alluvials,
(4) Red schist residuals,
(5) Red volcanic loam.

They occur in greater or less amounts, in all areas from Mossman to Tully: there are no schist alluvials in the Tully or Babinda areas, while red volcanic loams are absent from the Mossman and Tully districts.

These distinctive types have been kept in mind in the selection of sites for fertility trials, so that at the present time we are in possession of information regarding each major series, in addition to more specialised knowledge on minor variants.

(1) Granitic Alluvials.

This class embraces many of the river and creek flat soils of the Mossman, Mulgrave, Babinda and Innisfail districts. In their behaviour towards fertilizers, we find that they are frequently acid, and in need of liming. They also exhibit deficiencies in available phosphates and nitrogen, but are usually well supplied with available potash. An excellent example of this soil type is the Tropical Agricultural Station, South Johnstone, which was conducted for many years as a sugar experiment station. Our experiments showed consistently good and profitable results from the frequent use of lime, and the consistent applications of fertilizers rich in phosphates and nitrogen.

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* Reprinted from the current "Cane Growers' Quarterly Bulletin" by courtesy of the Director, Bureau of Sugar Experiment Stations, and with acknowledgment to the Queensland Society of Sugar Cane Technologists.

A number of our farm trials have been located on this type. A summary of the results gives the following average increase from modest application of nitrogen (as sulphate of ammonia), phosphoric acid (as superphosphate) and potash (as muriate) :—

TABLE I.

GRANITIC ALLUVIAL LOAMS.

Yield Increase Due to—	Plant Cane.	Ratoon Cane.
	Tons.	Tons.
Nitrogen (N)	2	5
Phosphoric acid (P)	5	6
Potash (K)	1	2
Total	8	13

The consistency over a range of trials confirms the general recommendations of the Bureau, for the use of Sugar Bureau No. 1 fertilizer mixtures, which are rich in phosphates and poor in potash. It will be observed that there is a marked increase for nitrogen on ratoons, whereas the plant cane response is relatively slight. Sulphate of ammonia should therefore be applied consistently to ratoons, even when green manuring has been practised prior to planting.

We have also the results of quantitative fertilizer trials on this soil type, which were designed to tell us the most profitable application per acre.

Though these are insufficient to allow of any fine conclusions, they indicate the need for the following :—

——	Plant Cane.	Ratoons.
Initial treatment.. ..	4 cwt. per acre, Sugar Bureau No. 1 Planting Mixture in drill	4 cwt. per acre, Sugar Bureau No. 1 Ratooning Mixture, when ratooning
Top dressings	2 cwt. per acre, sulphate of ammonia as top dressing (if farmer has not green manured)	3–4 cwt. per acre sulphate of ammonia, in two top dressings; the heavier application for old ratoons

(2) Granitic Residuals.

This class includes the characteristic gravelly loams of Babinda and Tully, as well as smaller areas of red granitic slopes at the foothills of certain districts. In spite of their low water-holding capacity, they are productive types in high rainfall areas, provided liberal fertilizer applications are made to maintain the available plantfood supply. In their behaviour towards the individual nutrients, they are rather similar to the granitic alluvials, as is shown in Table II.: this summarises the results to date on the gravelly soils.

TABLE II.

GRANITIC GRAVELLY LOAMS.

Yield Increase Due to—	Plant Cane.	Ratoon Cane.
	Tons.	Tons.
Nitrogen (N)	4	6
Phosphoric acid (P)	2	2
Potash (K)	0·5	2
Total	6·5	10

It will be observed that these soils give generally a higher plant cane response to sulphate of ammonia than do the alluvials; this is to be expected, when it is remembered that these soils are very deficient in humus. The yield increase due to phosphate is relatively slight, and we have some indication of a slight potash deficiency in ratoons.

On the basis of quantitative trials carried out on this soil type, we offer the following general recommendation:—

——	Plant Cane.	Ratoons.
Initial treatment.. ..	3–4 cwt. per acre, Sugar Bureau No. 1 Planting Mixture in drill	3–4 cwt. per acre, Sugar Bureau No. 1 Ratooning Mixture, when ratooning
Top dressings	2–3 cwt. per acre sulphate of ammonia as top dressing (if farmer has not green manured)	3–4 cwt. per acre sulphate of ammonia, in two top dressings

(3) Schist Alluvials.

This soil type is generally not "pure" in character, as the silts from which it is built are usually of mixed granitic and schist origin; we therefore apply the name to soils which are purely *or* predominantly of schist origin. Soils of this class constitute some of the most highly productive lands of the North.

Due probably to the lack of uniformity in the parent material from which these soils are formed, they exhibit marked variations in their behaviour towards artificial manures. It is generally true that they display definite nitrogen deficiency, and some remarkable yield increases are obtained from applications of sulphate of ammonia. The remarks for residual schist soils should be consulted for further comment on schist loams in general.

(4) Red Schist Residuals.

This soil type is one of the major cane soils of North Queensland. The general colour is red, and for this reason they are often confused with volcanic loams: indeed, the line of demarcation is particularly difficult to define where both types exist side by side. At times a moister variation of the major type exists, and this is brown in colour: where conditions of poor drainage occur, a characteristic white soil is obtained.

These soils as a class have been studied more extensively than any other type in North Queensland. This is the result of the lack of agreement obtained from areas even in close proximity. They are uniformly deficient in humus, and consequently, in available nitrogen: they therefore give good response to sulphate of ammonia. In certain cases an application of 4cwt. per acre has given increases ranging from 10 to 17 tons of cane per acre, with ratoons. As regards their reaction to phosphates and potash, we find sometimes one, sometimes the other is dominating, while on other occasions, both are in substantial demand.

The summarised results of Table III. illustrate this fact.

TABLE III.

SCHIST LOAMS.

Yield Increase Due to—	Plant Cane.	Ratoon Cane.
	Tons.	Tons.
Nitrogen (N)	3·4	8·4
Phosphoric acid (P)	2·5	2·0
Potash (K)	2·1	3·0
Total	8·0	13·4

These averages show clearly the need for sulphate of ammonia on this soil type, on both plant and ratoon crops: as regards phosphate and potash, the *average* increase is sensibly equal for both plantfoods: but if we should consider *extreme* cases, we have the following comparison, for trials located not more than one mile apart, on first ratoon crops:—

Increase Due to—	Farm "A."	Farm "B."
	Tons.	Tons.
Nitrogen (N)	3·8	12.8
Phosphoric acid (P)	4·8	2·8
Potash (K)	0·4	7·0

To quote another example, from a trial on red schist soil at South Johnstone, we found:—

Increase Due to—	Tons.
Nitrogen	2.2
Phosphoric acid	9.2
Potash	1.5

To generalise, then, we would offer the following advice; this will cover probably 75 per cent. of schist lands. It is best, however, for farmers on this class of soil to submit a sample for chemical analysis, as this can be relied upon to tell us the true state of the soil with reference to available phosphate, and to indicate the need or otherwise for potash; a specific recommendation then becomes possible.

—	Plant Cane.	Ratoons.
Initial treatment.. ..	3–5 cwt. per acre, Sugar Bureau No. 2 Planting Mixture, in drill	3–5 cwt. per acre, Sugar Bureau No. 2 Ratooning Mixture, when ratooning
Top dressings	3 cwt. per acre sulphate of ammonia, in two top dressings	3–4 cwt. per acre sulphate of ammonia, in two top dressings

(5) Red Volcanic Loam.

Substantial areas of this soil type are found in the far North, notably in the Innisfail and Babinda districts. The virtues of this soil from the point of view of its tillage qualities have frequently been extolled. It is also very interesting in its reactions to fertilizer, as it is the chief soil type which shows a definite and consistent potash deficiency: it is rarely if ever lacking in available phosphate, while yield-increases from sulphate of ammonia, even on ratoons, are not outstanding.

Applications of from 300-500lbs. of muriate of potash per acre have produced crop increases ranging from 6 to 14 tons of cane per acre, on plant cane. The highest increase was recorded on a field characterised by the presence of ''sterile patches'' which is so frequently strong evidence of potash deficiency on soils of this type.*

With ratoons, the crop increases for progressively heavier applications of potash are not so marked as for plant cane: and it would appear that the consistent application of 2cwt. of muriate of potash per acre is sufficient for customary yields. It is interesting to note, also, that the use of potash on this land influences the C.C.S. of the crop grown thereon, and farmers may expect permanent benefits from the practice. Our recommendations for red volcanic soils are as follows:—

—	Plant Cane.	Ratoons.
Initial treatment.. ..	4–5 cwt. per acre, Sugar Bureau No. 3 Planting Mixture, in drill	4–5 cwt. per acre, Sugar Bureau No. 3 Ratooning Mixture, when ratooning
Top dressings	2 cwt. per acre, sulphate of ammonia as top dressing (if farmer has not green manured)	2–3 cwt. per acre, sulphate of ammonia as top dressing

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* This should not be confused with similar patches on alluvial country; they usually denote excessive acidity and phosphate deficiency.

The Dairy Farm

Comfort for Cows.

WITH the dairy herd, a cold rainy spell always results in a falling off in production and—equally important but often overlooked—a falling off in condition. This may be regarded as an unavoidable evil, or, what is more likely, the dairyman blandly ignores it in the belief, probably, that the growth of feed after the rain will soon restore production to its original level or even raise it. But is such a temporary setback unavoidable? It is certainly not economical.

The remedy is not a matter of any great expense, or even of any great work. A corn-sack rug for each cow will mean the difference between a hungry herd, huddled into some inadequate shelter, and one out feeding even through the heaviest of showers, or on the coldest day. Two sacks sewn together lengthwise for the body of the rug and one across the withers and shoulders, short lengths of rope or cord for a breeching with ties under the belly and brisket are all that are necessary; about two shillings worth altogether, but a lot of comfort for a good cow. Although it won't be really waterproof, unless treated, until it has been in use some time, it is proof against the wind; and that is the real object, not to keep the cow dry but to keep her warm.

The usual objection is the labour of rugging and unrugging daily. Rugs are required on the cows day as well as night while the rain or cold weather lasts. When rugging in winter time the rugs should be removed on any fine day, but should be left on when the cold westerly winds are blowing. Any real herdmaster will rug throughout the winter, having once seen the comfort it provides for his cattle, in spite of the time taken in rugging and unrugging.—A. McDowal, Inspector of Dairies, Stock, and Slaughtering.

Cane Soils of North Queensland.*

N. J. KING.

THE canegrowing soils of North Queensland were discussed at the last Cairns Conference.† The maps submitted at that time were based on a preliminary soils survey carried out in 1930. During the latter half of 1936 the writer made a more detailed survey of these far northern areas supplying the Mossman, Hambledon, Mulgrave, Babinda, and Goondi Mills. The work will be continued as opportunity offers.

Several alterations and amendments were made in each mill district and the increasing volume of information being collected by the northern field officer, and per medium of fertility trials, makes possible a more detailed study of these soils. At the same time field experimental programmes are being vigorously pursued by several of the mill staffs, and the writer is particularly indebted to the staffs of Mulgrave and Goondi Mills, whose co-operation was of considerable value. The soil analytical survey initiated by the former mill should be of inestimable value to the suppliers in furtherance of an intelligent fertilizer programme.

Mossman.

Sugar cane agriculture in this area may be described as being carried out in a series of valleys and flood plains. Practically the entire area is alluvial, with only small agricultural development on the hillsides. On this account the cane area is not continuous. The more fertile land has been selected and assigned, leaving undisturbed poorer tracts of forest country between such fertile valleys. The flood plains of Whyanbeel and Saltwater Creeks, Mossman and Little Mossman Rivers, Cassowary Creek, and the Mowbray River and their tributaries cover the cane producing areas of this district.

Geologically, the alluvial soils are derived partly from schists and partly from granite. The influence of the latter is not noticeable except in the Whyanbeel Valley and on the Syndicate line. In these places the soils are usually gravelly—the small quartz particles from the granite having their influence in giving the soils an open structure of unmistakable granitic origin. In all other cases the Mossman alluvials are developed from schists, but during the processes of soil formation and flooding much mixing has undoubtedly taken place. It is probable that the large tracts of non-gravelly country are mixed schists and granitic alluvials, the gravel having separated out as the flood waters moved more slowly. The gravel is therefore found near stream banks or at the base of granite ranges.

The characteristics of these Mossman alluvial soils are (1) their general acidity, (2) fine particle size—they might be classified as a fine sandy clay-loam, (3) great depth of soil without change in structure, (4) uniform buff colour, (5) good moisture holding capacity, and (6) fair drainage. The soil surface is inclined to set somewhat after rain owing to the very fine sand present, but the crust is easily broken by light cultivation. The fertilizer requirements are firstly lime in most cases, and then applications of Sugar Bureau Mixture No. 1 with top dressings of sulphate of ammonia. In most fertility trials on this soil type excellent response has been obtained to phosphate and nitrogen,

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[*] Reprinted from the current "Cane Growers' Quarterly Bulletin" by courtesy of the Director, Bureau of Sugar Experiment Stations, and with acknowledgment to the Queensland Society of Sugar Cane Technologists.

[†] Some notes on the Soils of the North Queensland Sugar areas, by G. Bates.

with very few instances of gains from potash. Much money is being wasted annually in this district by indiscriminate fertilizing. It should be borne in mind that potash is one of the most expensive ingredients of mixed fertilizers and that soils of the Mossman alluvial type do not require a mixture rich in potash.

Occasionally one finds in these alluvial areas patches of whitish soils which appear to have all the general characteristics of the buff type, except colour. These whitish patches are usually associated with bad drainage, and should be treated as a poorly-drained area. The influence of drainage will be noticed in the improvement of crops and the gradual disappearance of the white colour.

The other soil types of the area which appear in small sections are (1) red schist, (2) red granitic, (3) talc schist, (4) stony schist alluvial, and (5) chocolate sandy soils. Small areas of red schist soil occur on hillsides on the edge of Saltwater area, on Bonnie Doon Estate, along Cassowary Creek, and in the Mowbray Valley. The red granitic soil covers only a small area on the north-west corner of Mango Park Estate. The talc schist soils occur on the south bank of the Mowbray River and the stony schist alluvials along Spring Creek.

The chocolate sandy soils occur near Mossman Beach. The most important of these types is the red schist, and this is discussed as a major soil type in the Hambledon area.

Hambledon.

In this Mill area cane growing is confined to three major types (1) the Barron alluvial, (2) the red schist, and (3) the ancient buff alluvial which is in most respects similar to that at Mossman.

The Barron alluvial soils can be classified as among the richest in Queensland. Their origin is bound up in the red volcanics of the Tableland, and the granites and schists of the Barron gorge. Almost annual flooding keeps up the fertility, particularly in regard to potash, but fertility trials have shown responses to phosphates (as with all other alluvial soils) and a marked crop reaction to nitrogen. There are many textural variations within the type, from very sandy soils to very heavy clays, but the average is a sandy loam of excellent texture and considerable depth. Moisture holding capacity is good. At about 18″ the soil becomes heavier, but not so clayey as to impede good drainage.

The red schist soils form, by area, the most important type of this district. They extend through Redlynch and Jungara up to the Intake on each side of Freshwater Creek; also through Edgehill and down to Wright's Creek on the east slopes of the range. Similarly most of the soils in Sawmill Pocket fall within this type. These red soils are not volcanic though frequently misnamed as such. Their chief characteristics are (1) reddish colour, (2) considerable depth without a marked subsoil, (3) droughty nature, (4) peculiar reaction to fertilizers. Their red colour is due to iron oxide, which varies from 2 per cent. to 12 per cent., the higher figures being obtained in the Redlynch area (*cf.* red volcanic soils in which iron oxide is between 22 and 25 per cent.). The droughty nature is associated with low clay content giving a poor moisture holding capacity. Fertility trials on red schist soils from Hambledon to Tully have given puzzling results. Always a response to nitrogen is obtained, but similar soils on two adjoining farms will sometimes give response to potash in one case and to phosphate in the other. This is explained by the northern field officer (Mr. Bates) as being due possibly to previous farm history. In the early days of cane farming the only fertilizers used were meatworks, bone, and offal—all rich in phosphates. The stage was eventually reached when potash deficiency developed and a response to potash would naturally result. On newer farms the normal phosphate deficiency of these soils and fair potash content manifests itself in giving phosphate responses to fertility trials. Advisory work on such lands is therefore intimately bound up with previous agricultural history. The chief defect of these soils is their low water holding capacity, and every effort should be made to improve this factor by a programme of green manuring and trash conservation.

The ancient buff alluvial soils are similar in most respects to those in the Mossman area, but are generally less acid; a similar fertilizer treatment is recommended.

Small areas of other soil types exist. The red volcanic soil occurs at Greenhill Estate and responds to a mixture rich in potash and nitrogen —as do other red volcanic soils. White soils occur on the flood plain of Skeleton Creek in the neighbourhood of Robert's Road, and in small areas at Sawmill Pocket. A mixed brown soil derived from admixture of red schist and alluvial occurs near the Carivonica School and just north of White Rock on the main road.

Mulgrave.

It is difficult to separate this from the previous mill area by any sharp line of demarcation. The soil types continue unbroken through each area. The red schist, ancient alluvial, red volcanic, and mixed schist-alluvial soils all occur in this area also. The recent alluvial soils along the flood plain of the Mulgrave can be closely correlated with those of the Barron. The only new soil type is the granite alluvial occurring from Aloomba to Fishery Creek.

The red volcanic soils in this area occur (1) just opposite the Experiment Station at Meringa, (2) a small development in Portion 65, parish Grafton, and a large tract on the south side of the Mulgrave in the upper part of the valley. Another small area also occurs in the Little Mulgrave. These soils are renowned for their excellent tilth, ease of cultivation, great productivity, and response to potash-containing fertilizers. They are also well known for the grub damage occurring thereon. They are well drained, but owing to their high clay content do not suffer from drought to the same extent as the red schist soils. Sugar Bureau Mixture No. 3, with sulphate of ammonia, is the recommended fertilizer treatment. The area opposite the Experiment Station is surrounded on all sides by red schist soil, and owing to the similarity in colour it is difficult to differentiate the two types. Three samples taken here show by analysis the gradation from the red volcanic to the red schist.

Soil Type.	pH (Water Suspension).	Avail. P_2O_5	Avail. K_2O per 100 gm.	Fe_2O_3
		p.p.m.	M.E.	%
Red volcanic	6·8	245	·40	18·6
Mixed volcanic and red schist ..	6·6	125	·30	15·9
Red schist	6·7	54	·37	6·5

The granitic alluvial soils first appear in the gorge south of the Pyramid and extend west and south through Charringa, Meerawa, to the southern boundary of the mill area at Fishery Creek. These soils contain much fine quartz gravel, but also have a good clay content and moisture holding capacity. Much of the land of this origin is even swampy and unsuitable for cane production. Such soils respond to nitrogen and phosphates, there being usually sufficient potash present from decomposition of felspars and mica in the granite. It is difficult to detect accurate soil boundaries in parts of this area. From the Pyramid working east one traverses red schist soil, mixed schist and old buff alluvial, buff alluvial, recent Mulgrave alluvium, and on the southern boundary of some of these types occurs the granitic alluvial soil. It is apparent that much soil mixing has developed at the various boundaries, but fortunately all alluvial soils—irrespective of their origin—appear to have similar fertilizer needs. The red schist development disappears at Aloomba, the ranges further south being principally granites and gneisses.

Babinda.

In this mill area the granite alluvials are the principal soil type, and conform in all respects to those encountered in the Mulgrave area. They are for the most part low-lying and rather poorly drained, much of the land being originally under palm swamps. They are of a more or less heavy nature, and, if worked too wet will form hard lumps. Hard-pan formation is common, and excellent results have often been obtained from subsoiling. The soils are almost exclusively acid (pH 3.8 to 5·4 in KCl suspension), indicating that liming should be a general practice. The excessive rainfall of this district is responsible for extensive leaching of the soils, and only systematic fertilizing can keep such lands in a state of high productivity.

On the hill slopes of the area a reddish soil demonstrates the younger granitic soil development *in situ*. These red soils are very gravelly and well drained. They are essentially a skeleton soil of quartz, felspar, and mica particles, the finer products of decomposition being washed away as quickly as formed. In an area of such heavy rainfall there would appear to be little future for such soils, the erosion factor having too great a bearing on their ultimate life.

Large tracts of rich alluvial country exist along the Russell River in the Bucklands Road area and west beyond Bartle Frere. Similar developments occur on the south bank of the Russell between these points. This soil differs from the recent Barron and Mulgrave alluvials in appearance—probably on account of difference in origin—but the fertilizer deficiencies are similar. The soil is brownish, free of gravel, rather heavy in texture, and contains much mica. It is usually acid. The soil is deep, but subject to hard-pan development at plough depth.

Red volcanic soils occur in Babinda area at Harvey's Creek, Happy Valley, Bartle Frere, and near Qunaba Estate on the south bank of the Russell. Of these the best development is at Bartle Frere where fertilizer trials have given consistent responses to potash and nitrogen, up to 500 lb. per acre of the former still showing a profitable return.

Goondi.

This mill area is remarkably compact and extends over only three soil types (1) the Johnstone alluvial, (2) the red volcanic, and (3) the extremely poor Mundoo soils.

The Johnstone alluvial differs in no way from the Russell alluvium except that the colour is somewhat lighter. Texture, origin, depth, and fertilizer responses appear to be similar, and the normal acidity of the North Queensland alluvials is again apparent in this district. Both sides of the Johnstone River contain extensive flats of this alluvial type, and the Goondi area also includes portion of the flats on the north bank of the South Johnstone River. The isolated Innisfail Estate is of similar type. Granite and schist contribute principally to the origin of these alluvials, and as in the case of the more northern river soils, phosphates and nitrogen give good responses. Lime is nearly always required.

The major portion of the Goondi district is covered by the red volcanic type—the largest development of basaltic soil yet encountered. This red volcanic is in no way dissimilar to those met further north either in origin, texture, depth, composition, or response to potash and nitrogen. The soil does not require lime.

The Mundoo red soil—with which must be included another small area at Todd's corner, north of Garradunga—has long been a problem in cane production in this area. Although red in colour, of good tilth, well drained, and subject to the same climatic influences as the rest of the district, this soil fails to produce crops of even average magnitude under the best conditions. Much of the Mundoo country has been allowed to go out of production altogether, and this fallow country cannot support even a poor growth of grass or lantana. Heavier than average dressings of complete fertilizers do not show anything like the response obtained on the adjoining red volcanic soil. A careful examination of this soil—and of the area at Todd's corner—showed the following deviations from the red volcanic:—

(1) Sand was present in the soil.
(2) The clay content was obviously low.
(3) Moisture holding capacity was very low.
(4) Veins of ironstone occurred at varying depths and pieces of quartz sometimes occurred associated with these veins.
(5) Grass and lantana growth on land now out of production was exceptionally poor.

These observations showed definitely that the soil was not a normal red volcanic. Analysis of typical soil samples from Mundoo area and Todd's corner are shown in Table I., and for purposes of comparison is included an analysis of a true red volcanic soil. The figures for phosphates and potash explain the extreme poverty of the soils; the high total iron content is important in its relation to origin. The extremely low phosphate content is also at variance with normal red volcanics, and the depressed moisture equivalent implies a lower clay content. All these factors, combined with field geological observations, led to the following theory for the genesis of this soil. During the flow of a basaltic lava there sometimes occurs the concentration at certain points of the flow of ore bodies associated with quartz veins. In such cases the quartz is usually very friable and can be reduced to sand by the fingers alone. It is thought, therefore, that the Mundoo and Todd's corner soils are developed from such concentration bodies. The presence of so much quartz sand in a basic lava, the abnormally high iron content, and the numerous ironstone veins are thus explained. At Todd's corner the sand phase is entirely surrounded by the normal volcanic soil, the line of demarcation from poor to good soil being sharply defined. Table I. illustrates some of the analytical figures obtained.

TABLE I.

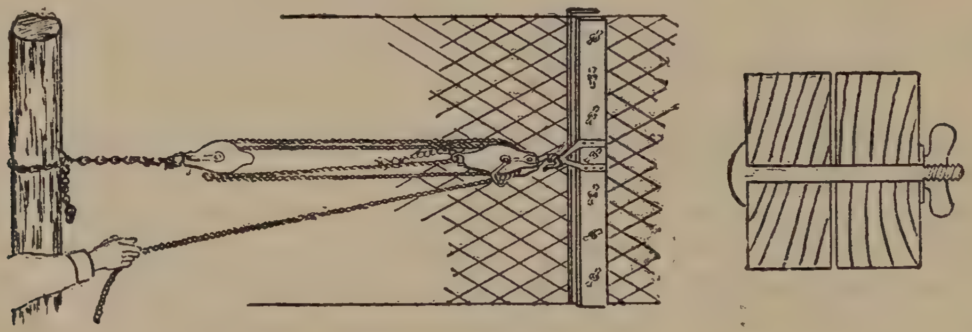
Soil.	Avail. P_2O_5	Avail. K_2O per 100 gm.	Replace CaO per 100 gm.	Coarse Sand.	Fe_2O_3 on Sand-free Soil.	Moisture Equivalent.
	p.p.m.	M.E.	M.E.	%	%	%
True red volcanic	116	0·30	9·7	3·4	20·3	32·0
Todd's Corner	11	0·13	0·5	25·1	34·9	24·0
Todd's Corner	19	0·09	0·4	18·2	36·7	28·5
Mundoo ...	3	0·07	0·4	11·0	30·0	29·4
Subsoil of above	4	0·07	0·1	26·4	34·8	25·6

A WIRE-NETTING STRETCHER.

Wire netting and woven wire fences can be set up perfectly taut with the help of a handy and simple outfit devised by an Argyllshire reader. This home-made stretcher is strong enough to stand any pull and powerful enough to stretch any length of fence required.

The clamp is made of two pieces of oak fixed together with seven ⅜-inch bolts. It is best to have bolts with thumb-screw nuts for the clamp can then be adjusted easily and moved about without being obliged to make use of a screw key.

The blocks used are of a small pattern with 2-inch sheaves, and the arrangement is such that the pull is away from the wire towards the post. The direction of the pull is clearly shown in the drawing given above.



Illustrating the wire-netting stretcher at work, with (right) a section through the clamp to show the arrangement of the bolt and thumb-screw nut.

With a double block as shown there is no slip, and a one pound pull on the rope is equal to four on the wire. The block next the clamp should have a hook on the end to go into the double eye of the clamp. The eye plate of the clamp is arranged by having a plate on each piece. These plates are set in to meet in the middle of the thickness of the wood so that when they are together there is no difficulty in connecting the block.

The arrangement, our reader states, is simple and works easily; every movement of the rope stretches the wire several inches when it is held in a vertical position.—"The Farmer and Stockbreeder (England)."

The PIG FARM

Maize and Pork Quality.

OWING to its relatively high fat content and the low melting point of its fat, maize can be responsible for the production of soft fat in pork and bacon.

A sweeping statement is sometimes made that "maize fed" pigs are soft as compared with pigs which have been fed on wheat or barley. The statement really needs some qualification so far as Queensland pigs are concerned. A large number could be classed as "maize fed," but they rarely receive sufficient maize to cause soft pork or bacon.

Maize is the most widely grown grain in Queensland, but the pig industry is not dependent on this crop. It is very closely associated with dairying, the pigs being used primarily to consume the milk by-products—separated milk, butter-milk, and whey. Pasture, forage crops, and root crops also form a large part of the diet of pigs on some Queensland farms, and the grains—maize, wheat, and barley—are really only used as supplementary foods.

These points should be borne in mind when reading the advice of some overseas authorities, who state that maize should not constitute more than about 35 per cent. of the grain allowance of pigs. This may be sound advice under English conditions where pigs frequently receive a diet which is about 90 per cent. grain and which usually does not contain milk products, but under Queensland conditions, where the feeding systems are as stated above, there appears to be little danger of pigs receiving sufficient maize to injure their carcass quality.

Most of the pigs produced in Queensland can be classed as "milk fed."—W. A. Downey, Instructor in Pig Raising.

Some Notes on Rat Control in the Mourilyan Area.*

E. H. FOX.

ALTHOUGH a good deal of rat control work had been attempted intermittently by the various Northern pest boards prior to 1934-35, the problem had only occasionally assumed serious proportions, and was usually considered a matter for local, even individual, attention, rather than one of major interest to the industry as a whole.

When it became necessary, therefore, to commence large-scale control operations, the necessary published data for their success were virtually non-existent, and most field investigators had to commence with the "trial and error" method, picking up such information as came their way during the more pressing business of practical attempts at control. It was assumed, at least among the majority of farmers, that a rat was simply a rat; a poison, poisonous; and any foodstuff a suitable medium for carrying the poison.

Undoubtedly there were a number of excellent formulæ in existence, giving lethal dose and recording details of tests, but many of these had been evolved for the destruction of house-rats, and few, if any, had been carefully checked under Queensland field conditions. However, they formed a basis on which to start work, and because of the urgency of the position, it was not long before new clues were being unearthed and exchanged and the classification and description of species under way.

Results at Mourilyan, as elsewhere, have often been confusing; success, for instance, under one set of conditions has often become failure under what appeared to be similar conditions; but certain broad conclusions or at least tendencies can be traced, and may be worth testing in other districts. It should be noted that our captures, alive and dead, suggest that over 90 per cent. of our field rats belong to the *Melomys littoralis* species, also that the destruction of harbourage has been actively pursued simultaneously with poisoning campaigns, and has undoubtedly brought results, and this, combined with the impossibility of evolving a check on field operations, renders more complicated the question of effectiveness of poison baits.

The evidence is overwhelming in favour of continuing poisoning operations, however, under our local conditions; thus the use of thallium-coated wheat has given 100 per cent. kill in dozens of cage tests, packets laid in fields showing extensive rat damage have been opened and the contents eaten, occasionally dead rats having been found, and in many cases damage to cane has ceased—temporarily. Certainly not in all cases, but whilst one such case noted could be passed over as an accident and the second as a coincidence, when it happens fairly regularly it seems logical to assume a measure of success for the method. It was admitted, of course, and still is, that there are probably factors operating which are neither controlled nor understood.

These activities soon pointed to another important question—what constitutes the adequate baiting of a paddock? Our most striking successes had been obtained under conditions of very lavish baiting (of the order of 2,000 baits per acre) and anyone who has attempted the baiting of a badly infested paddock of lodged cane will realise the absurdity of putting down a few hundred baits around the headlands of a large paddock. Having once admitted the poisoning method as a handy and more or less effective one for the destruction of rats, it naturally followed that a more regular and complete baiting of paddocks was desirable if it could be accomplished economically.

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* Reprinted from the current "Cane Growers' Quarterly Bulletin," and with acknowledgment to the Queensland Society of Sugar Cane Technologists.

A three-weekly issue of 1,000 baits for every farm in the area, whether rat infested or not, was aimed at as a minimum, with large reserves for those farmers who, because of extensive damage, either applied (themselves) for more or were advised that they required more. Obviously thallium wheat baits were too expensive to be used on such a scale, so other types were tested, and finally bread and phosphorus baits, as described below, were used for the regular campaigns in dry weather, with packeted wheat as an occasional change and for wet weather application.

The results of our cage tests showed:—

(*a*) One hundred per cent. kill in all cases within twelve hours of the rat taking even the smallest bite.

(*b*) The tinted, or poisoned, face of the bread cube was apparently the most palatable.

(*c*) Baits appeared to retain their palatability and potency after being kept one month in an airtight tin.

(*d*) Baits were still potent after twenty-four hours in the paddock.

The method of manufacture is still being improved, but consists at the moment in slicing large sandwich loaves into twenty-eight to thirty slices, laying them on a board which is constantly being smeared with phosphorus paste (made to Dr. Cilento's formula), dipping the sticky face in a mixture of flour and sugar, and finally cutting the slices into cubes by means of a cheap salad cutter. The cubes are then put into 4-lb. bags, labelled, and packed in air-tight tins for delivery.

It is possible to cut 4,000 baits from a double sandwich loaf, and the fresher the bread the more easily will it be found to cut. Instead of brushing the thick paste (previously warmed) directly on to the bread, it saves time to smear it on a heavy, shining surface, such as marble or a piece of thick glass, by means of a paint brush, and to press the slice down firmly on this. It is also found advisable to carry each process through quickly without any accumulation at each step, because of the rapid drying of the bread, with the consequent difficulty in cutting it.

The salad cutter, costing about 2s., is imply a series of thin sharpened metal discs, 3 inches in diameter, revolving on a common spindle and encased in a metal guard. It is capable of improvement for this work—a heavier and stouter one would handle the crusts better. Indeed, refinements are no doubt possible throughout all stages of manufacture, but the following figures of actual costs will serve to show how cheaply these baits are being prepared. Costs of supervision and delivery are not included. The cost of carriage on phosphorus paste is included, but, if carried freight free, it would reduce this charge from 1s. 8d. per lb. to 1s. 3d., reducing the total cost of baits to about 8d. per 1,000; whilst, if mixed on the premises, this charge of 1s. 8d. per lb. for phosphorus would be still further reduced to 8d. per lb. or less.

Cost of manufacturing 180,000 phosphorus rat baits:—

	£	*s.*	*d.*
45 double loaves at 10d.	1	17	6
45 lb. phosphorus paste at 1s. 8d.	3	15	0
Labour (youth, 2 days)	0	16	8
Flour and sugar	0	6	0
Bags	0	1	8
Labels	0	3	0
"Clag"	0	0	6
	£7	0	4

or a little over 9d. per 1,000 baits.

Their small cost has enabled us to lay a total of 1,386,000 baits over a comparatively small of approximately 8,000 acres net in nine months, and in the writer's opinion this is lower than the minimum needed for prevention of damage, and considerably lower than that required for clearing up harbourages already heavily infested. Damage throughout the area last year was so low (from whatever cause) that we feel justified in continuing our present methods even more extensively until such time as a better method of control is evolved, or unmistakable proof is forthcoming that we are drawing wrong inferences.

QUEENSLAND SHOW DATES FOR 1937.

May.

Longreach	3rd to 6th
Beaudesert—	
Show	5th and 6th
Bushmen's Carnival	7th and 8th
Wallumbilla	6th and 7th
Nanango	6th and 7th
Dirranbandi	6th to 8th
Ipswich	11th to 14th
Wowan—	
Show	11th and 12th
Rodeo	13th
Biggenden	20th and 21st
Gympie	20th to 22nd
Warrill View	22nd
Kilkivan	24th and 25th
Maryborough	25th to 27th
Charleville	25th to 27th
Maryborough	25th to 27th
Gin Gin	28th and 29th
Toogoolawah	28th and 29th
Kalbar	29th
Childers	31st May and 1st June

June.

Bundaberg	3rd to 5th
Lowood	4th and 5th
Boonah	9th and 10th
Gladstone	9th and 10th
Marburg	18th and 19th
Rockhampton	22nd to 26th
Mackay	28th June to 1st July

July.

Bowen	7th and 8th
Ayr	9th and 10th
Rosewood	9th and 10th
Cleveland	9th and 10th
Townsville	13th to 15th
Nambour—	
Show	15th and 16th
Campdraft	17th
Esk	16th and 17th
Charters Towers	20th and 21st
Laidley	21st and 22nd
Maleny	22nd and 23rd
Cairns	27th and 28th
Gatton	28th and 29th
Caboolture	30th and 31st

August.

Royal National, Brisbane	16th to 21st
Crow's Nest	4th and 5th

September.

Imbil	3rd and 4th
Rocklea	11th
Innisfail	17th and 18th

November.

Murwillumbah	3rd and 4th

A Modified Irrigation Method.*

B. TAPIOLAS.

IN a paper on "Irrigation Principles" presented by Kerr at the 1933 Conference,† brief reference was made (Proceedings, p. 104) to a method of "one-side" irrigation, which was being tested in the Burdekin area. The writer has given further close study to the method since that time, and is now able to report that it has been developed into a very satisfactory scheme for both plant and ratoon cane irrigation.

The characteristics of the Burdekin alluvial soils were accurately described by Kerr and Cassidy,‡ and the difficulty in keeping these soils in a well-cultivated state between waterings is one of the biggest problems the farmer has to contend with. The ill-effects of the water on the soil also increases the difficulty of raising satisfactory crops, and this is particularly true of ratoons. The writer has therefore concentrated his attention on a method which would bring about the following improvements:—

(1) Reduction in the number of cultivation operations necessary.

(2) Water economy.

(3) Assistance in the retention of a favourable tilth in the surface soil, by minimising the ill-effects of water and implements.

Early efforts were confined exclusively to ratoons, and an implement was devised which would enable the cultivation of the land to be carried out in a few operations. At the present time, the standard ratooning practice is as follows:—Bumper discing, to create a surface mulch and level the land; ploughing away from both sides of the stools; subsoiling or grubbing; scarifying to level the interspace; preparing water furrows for irrigation; surface cultivation to restore tilth; hilling-up, in preparing water furrows; scarification, &c., after each watering, and the necessary repairing or re-shaping of water ditches before each subsequent irrigation. By the improved method, the number of operations is reduced to the following:—Bumper discing; ploughing away; sub-soiling to 15 inches, and preparing 10-inch furrow close to one side of the cane stools, all in one operation. As many as four light waterings may then be given, before cultivation for weed control becomes necessary, as the manner in which the water is applied keeps the surface soil of the interspaces dry, and the soil tilth is therefore not destroyed. When it becomes necessary to check weed growth, this is done by one operation with the combined implement. By this time the ratoons are well advanced in growth, and thereafter, watering only is necessary.

A brief description of the implement, assisted by the accompanying sketches and photographs, should make the essential features clear. It was built up by the writer from portions of old implements on the farm. To a standard tractor-grubber frame three mouldboard ploughs were attached in a special manner (*see* Plate 136). A pair of 7-inch ploughs placed at a distance of about 24 inches between share points, were so attached as to throw a light furrow *on* to the cane stools; they were set so as to turn the surface 3 or 4 inches of soil, and effectively smother all weed-growth in the cane row. Following the right-hand plough, and set at a distance of about 4 inches nearer the cane stools, is a 10-inch mouldboard plough, which turns a furrow 10 inches deep *away* from the cane row. To the tip of the wing of this plough is attached a leveller, consisting of a horizontal iron bar braced to the grubber frame as shown in the illustration (Plate 136). To balance the implement, and to produce a sub-soiling effect, one grubber tyne with a chisel point is attached on the side opposite from the 10-inch plough, and operating towards the centre of the interspace. The effect of the implement on the soil is shown by the series of sketches (Plate 137). The implement is drawn by a tractor straddling the cane rows.

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* Reprinted from the "Cane Growers' Quarterly Bulletin" with acknowledgment to the Queensland Society of Sugar Cane Technologists.

† Annual Conference of the Queensland Society of Sugar Cane Technologists.

‡ "The Soils and Irrigation Waters of the Burdekin Delta"—Q'land Agric. Jour., 1932, p. 115.

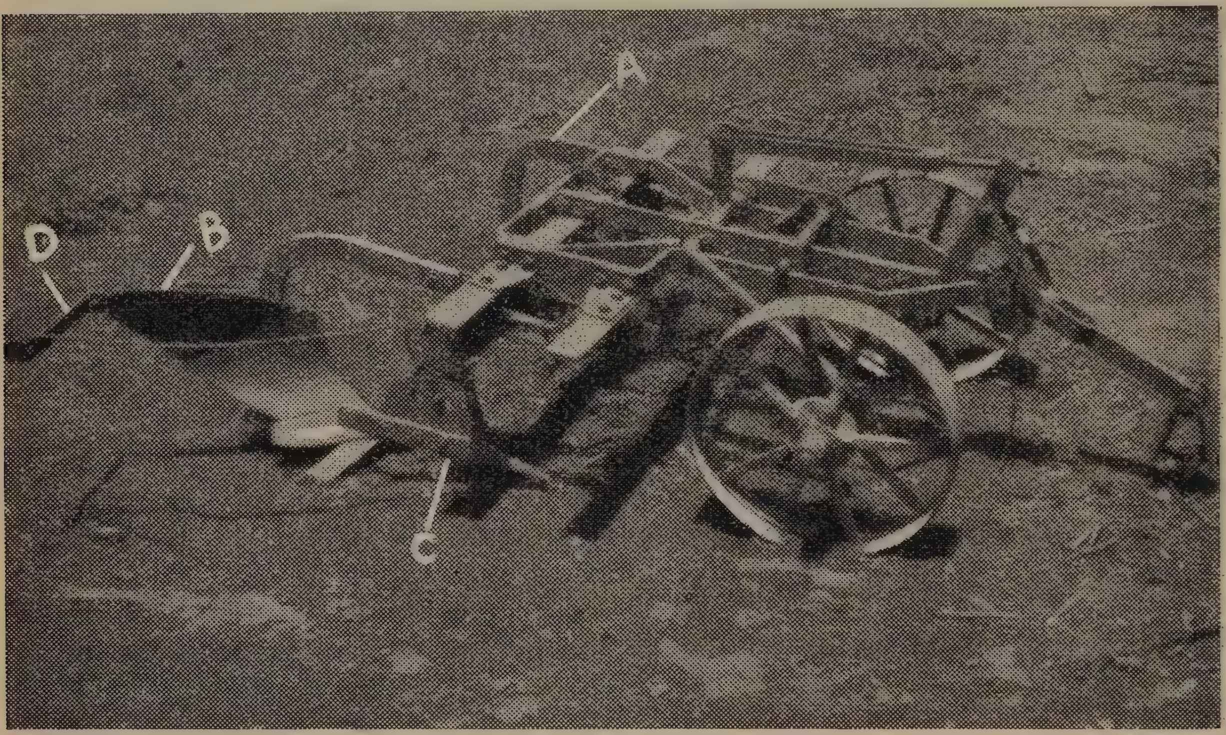


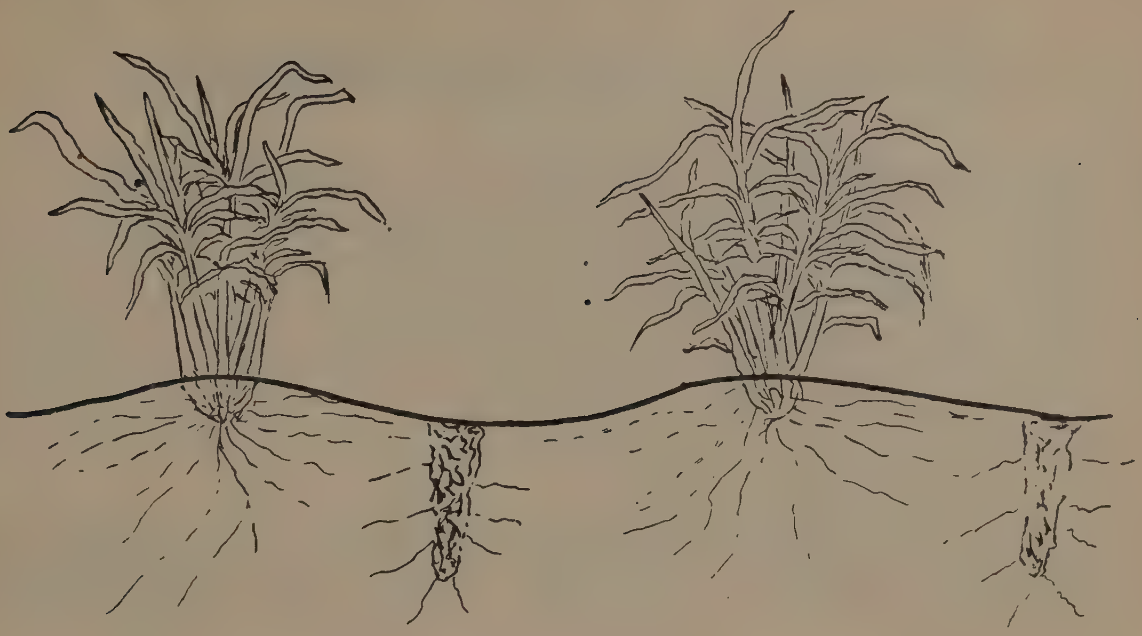
Plate 136.

Illustrating the essential features of the combined implement—A 7-inch plough, B 10-inch plough, C subsoiler, and D leveller, attached to plough wing. *Note.*—One of the 7-inch ploughs is absent from the machine, which was arranged for simplicity in photography.

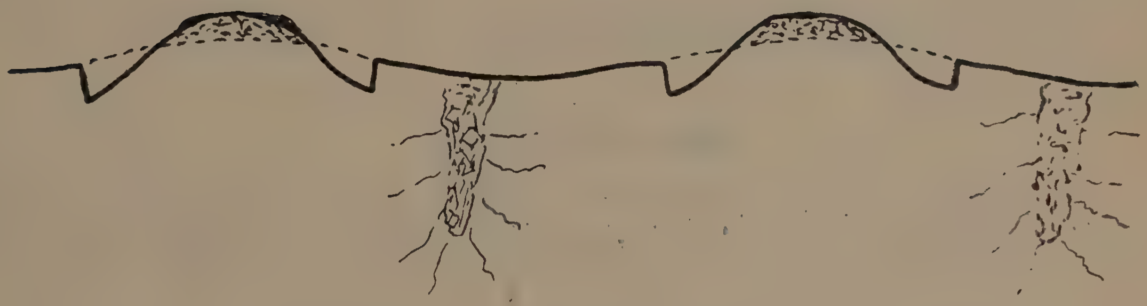
As the implement is worked in "lands" of eighteen rows, it will be obvious that the central interspace of the land will carry no water furrow; in this interspace the tramline is laid.

It was found, also, that the implement worked very satisfactorily in plant cane. The depth of the 7-inch ploughs was in this case raised by means of the adjustable beam so as to turn only the surface 2 inches of soil from either side, and thus avoid hilling of the cane; the water-furrow was run at a 10-inch depth, as for the ratoons.

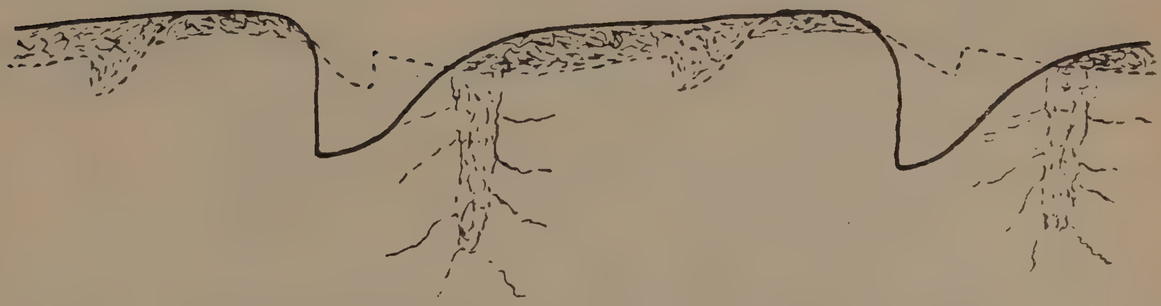
After the job is completed the field is free of weeds, and thereafter watering only is necessary. The deep water-furrow ensures deep penetration of the soil and subsoil, while the interspace surface remains quite dry unless rain should fall. Weed growth is therefore prevented, and the cane crop is encouraged to develop a deep rooting system, which means resistance to drought. On lands where rather saline waters are being used the upward rise of water and concentration of soluble salts in the surface soil is also prevented. The fact that cultivation is



(1). Subsoiled.



(2) Weeds smothered.



(3) Water Furrows Completed.

Plate 137.

Showing the successive operations performed by the combined implement.

reduced to a minimum also gives the soil a chance to recover its crumby structure, and makes for a permanent improvement in the tilth of the land. The method markedly increases the area which a man can irrigate daily, while bringing about an economy in water utilization amounting to probably 30 per cent.

The writer would state quite definitely that the modification in irrigation procedure as described above is the biggest forward step he has taken since he adopted the use of artificial manures as a standard practice.

Notes on Farm Horse Rations.*

D. L. McBRYDE.

IN the July, 1935, issue of the *Cane Growers' Quarterly Bulletin* an article on ''Feeding Farm Animals'' was presented. This arose out of a discussion on farm horse rations which took place at the Bundaberg Conference in April of that year; while many farmers contended that they were able to maintain their animals in good working condition on a ration consisting of ''chop,'' molasses and linseed meal, others were equally emphatic that it was essential to employ maize or some other grain in the feed.

It is well recognised that molasses is the cheapest form of carbohydrate available on the cane farm, and that horses are able to utilize from 6-8 lbs. per day without detriment. It therefore replaces, theoretically at least, the starches supplied by maize, though it is not so rich in proteins.

In order to test the value of this feeding material, the farm horses at the Mackay Experiment Station were placed on a ration of ''chop-chop'' (or other roughage during the slack season), molasses and linseed meal, with a small addition of mineral lick.

Standard Ration.

The horses are fed three times daily during the working week, twice on Saturday, and once on Sunday, while they are in constant work. At other times, if the paddocks are bare, as is usually the case during winter and spring, two feeds are given daily, except on Sunday, when the animals are fed once. If there is good grass in the paddocks, only one feed is given daily during periods when the horses are idle or in light work.

The components of the feed, and the approximate quantities given are:—

Chop-chop	18 lbs.
Molasses (heavy)	2 lbs.
Linseed meal	1 lb.

These quantities are adhered to by employing measuring tins; in addition, about 1 oz. of lick per day is supplied, to make good any mineral deficiency.

When cane tops are not available, panicum or guinea grass, or both, are chaffed for the horses. This feed is usually cut in sufficient quantity to carry through for two or three days, and except for the needs of the first day, the grass is allowed to dry for a short period before it is taken to the barn.

It is of interest to study the true feeding value of the above-described ration, to determine whether it agrees with the generally accepted standards.

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* Reprinted from the current ''Cane Growers' Quarterly Bulletin'' by courtesy of the Director, Bureau of Sugar Experiment Stations, and with acknowledgment to the Queensland Society of Sugar Cane Technologists.

The analyses of the materials are as follows:—

Feedstuff.	Crude Protein.	Crude Fat.	Crude Fibre.	Crude Carbo-hydrate.
	%	%	%	%
Chop-chop	1·6	0·7	9·0	16·9
Molasses	5·9	—	—	50·0
Linseed Meal	31·4	6·4	10·2	36·8

Making due allowance for the quantity of each in the ration, and the digestibility of each nutrient contained therein, the following amounts of nutrients are given daily:—

Feedstuff.	Dry Matter.	Digestible Proteins.	Total Digestible Nutrients.	Nutritive Ratio.
	lb.	lb.	lb.	
Chop-chop—54 lb.	16·2	0·2	11·3	—
Molasses—6 lb.	4·5	0·1	4·7	—
Linseed Meal—3 lb.	2·7	1·0	2·4	—
Total	23·4	1·3	18·4	1 to 11
Minimum requirements	23·4	1·8	16·9	1 to 8

Discussion.

It will be observed that, without making any allowance for the value of grass obtained by grazing, the animals receive an abundance of dry matter, which is rather rich in total nutrients, but slightly deficient in digestible proteins. It would therefore be an advantage to increase the linseed meal, or substitute portion by a meal richer in proteins and lower in fat.

The accompanying photograph (Plate 138) shows the condition of the animals at the conclusion of the past harvesting season, when they had been fed this ration for eighteen months. It is found that the horses fatten between spells of steady work, but do not soften as their appearance might suggest. They come back into hard trim without any trouble, such as is the case, at times, when horses are given a heavier ration of molasses.

A noticeable improvement since adopting the above feeding systems was that of the condition of skin and coat, which lost all signs of scurf. This improvement was due, undoubtedly, to the linseed meal. Factors operating during the past eighteen months were decidedly against the well-being of the animals, particularly from May, 1935, to February, 1936, when the horses were without shade or protection from the weather. It might be stated that the horses get little, if any more grooming than would the usual farm horse.

Plate 138.
Farm horses on Mackay Experiment Station, at the conclusion of the harvesting season.

THE USE OF UNSUITABLE FERTILIZER MIXTURES.

The correct fertilization of any crop lies in the ability to supply to the soil those particular foods required by the plant which the soil is unable to supply.

With a view to obtaining this information the Bureau of Sugar Experiment Stations has for the past eight years carried out numerous fertilizer trials on different farms covering a wide range of soils. This collection of a vast amount of data enables us to gauge with accuracy the particular type of fertilizer which will give the most payable return on any particular soil type. In view of this information special fertilizer mixtures have been compounded to suit these soil types, and are known as Sugar Bureau Mixtures Nos. 1, 2, and 3.

It is surprising, after the amount of publicity given these results and the recommendations made, to find that farmers are frequently using mixtures that are both more expensive and unsuitable. A good example is the use of a high-potash mixture on the acid alluvial lands, where a cheaper mixture containing more phosphate and less potash will give a larger tonnage. Another illustration is the use of high-phosphate mixtures on red volcanic soils, which require lots of potash. Such a mixture, while cheap per ton, is expensive in the long run.

If there is any doubt that the correct type of fertilizer is being used, an inquiry directed to the nearest officer of the Bureau of Sugar Experiment Stations will receive attention.

G.B. (in the "Cane Growers' Quarterly.")

Mule Breeding at Bundaberg.

N. J. KING.*

SOME eighteen months ago three jack donkeys were selected in the United States of America, for the purpose of attempting to breed good type mules for work in the Queensland canefields. Two of these animals were purchased by the Fairymead Sugar Co. Ltd., while the third animal was taken to the Burdekin area.

Through the courtesy of the Fairymead Sugar Company, we have pleasure in presenting the accompanying illustration (Plate 139) of a few mule colts which were dropped between early October and late December, 1936. We also reproduce the sire of these animals (Plate 140), a jack of 15.1 hands standard measurement, now eight years old. He was a well-tried animal in Kansas, and produced mules of excellent type in that country.

Plate 139.

A group of mule colts, 3-5 months old, sired by the jack pictured in Plate 140.

At Fairymead Plantation he was mated with 16-hand Clydesdale mares, and to date he has produced 11 foals. The height of the youngsters compares favourably with that of Clydesdale foals of the same age, while their weight is also practically identical. They have been fed uniformly with the usual foals on the plantation, and no variation in treatment has been introduced to date. The outstanding characteristics of the mule colts are their playfulness and inquisitiveness.

It is intended that they be handled and broken in to work as two-year-olds, and put to farm work at the age of three years.

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* In the current "Cane Growers' Quarterly." Reprinted by courtesy of the Director, Bureau of Sugar Experiment Stations.

Growers will doubtless be pleased to learn of the early success of this experiment, and will await further results with interest. As only one class of mare has been used for breeding—an attractive type of farm animal—it is not possible to suggest whether the mule type would vary with variation in the type of dam.

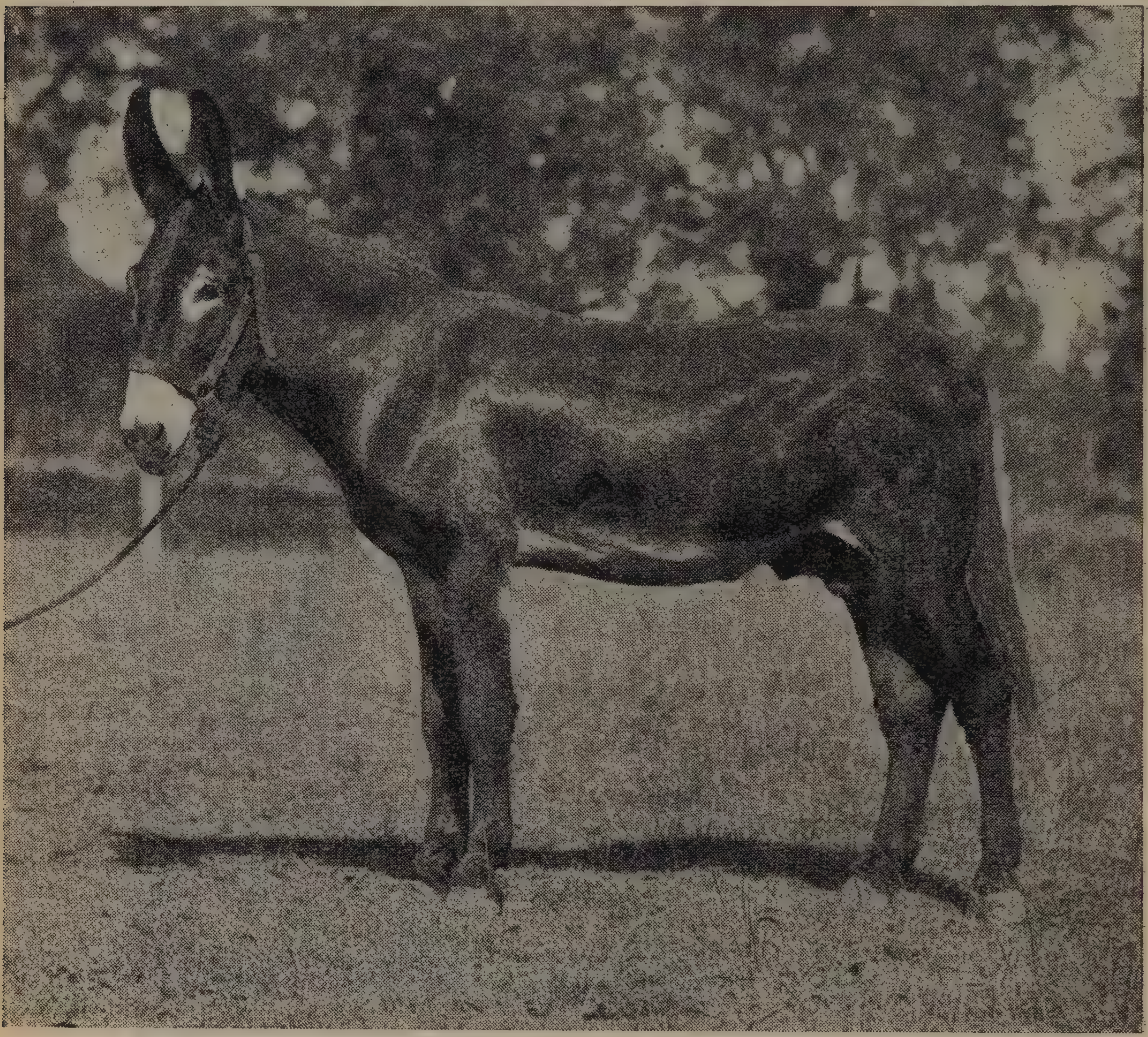


Plate 140.

The sire of the colts pictured in Plate 139. This jack is eight years old and stands 15.1 hands.

THE RISK OF FEEDING ENGLISH POTATO STALKS AND LEAVES.

It has recently been reported to the Department of Agriculture and Stock by one of the veterinary staff that seven dairy cows died suddenly on a farm in the Helidon district. The cows were given a corn bag full of English potato stalks and leaves. A post-mortem examination showed that the rumen was very full and that the potato tops constituted a considerable portion of the contents.

In this connection, it might be pointed out that English potato tops are extremely dangerous feed for stock. They are sometimes used in Europe, and numerous cases are on record there of horses and cattle being poisoned through eating them.

Two poisonous principles are present—both alkaloids—named solanine and solanidine, respectively. They occur to a more limited extent in the ordinary potato peel, and are also present in green potatoes. In the ordinary white, starchy part of the potato they are totally or almost totally absent. Cases are on record, also, in which pigs fed on uncooked sprouted potatoes were affected with slowly progressing paralysis which became complete after about twenty-four hours. Death may or may not result, but in any case the feeding of potato tops and leaves is always attended with risk.

Agricultural Notes

COTTON.

The favourable progress of the cotton crops reported during February has not continued so satisfactorily during March, due to dry conditions and moderate attacks by various insects being experienced in the first half of the month. This is particularly true on the older cultivations, where the severe storms did not penetrate so deeply as on the more open newer cultivations or where cotton followed grassland. Excellent demonstrations of the value of growing cotton in rotation with grassland have been obtained in all districts this season, and undoubtedly a much greater factor of safety can be obtained where such a practice is followed.

The harvesting of the earlier-sown crops has started in all of the main cotton-growing districts, but has been appreciably delayed by the splendid rain group occurring at mid-month when 4 inches or more was received over the cotton areas. Such a soaking rain will promote the formation of a splendid top crop, however, and if frosts are moderately late reasonably good yields may be expected in many districts.

SUGAR.

All cane areas were favoured with excellent growing conditions during the month of March. Heavy tonnages are now practically assured in all areas from Mackay north. The heavy rains of mid-March came in time to give the southern areas a chance to produce a crop before growth is checked by wintry conditions. Even now the situation is critical, and a continuance of favourable conditions essential to ensure a moderate crop.

AUTUMN PLANTING OF ENGLISH POTATOES IN CENTRAL QUEENSLAND.

In Central Queensland, the winter crop of potatoes is normally planted between mid-February and March, and as the growing season is short, harvesting is usually in full swing by June. Climatic conditions are responsible for the comparatively short period between planting and maturity, and also the smaller yields in comparison with those obtained in more temperate regions.

Trials have disclosed that although the tubers attain normal size, the number per plant in this crop is comparatively low, which suggests that yields could be increased by closer planting. This opinion is confirmed by the successful crops obtained in areas where the seed tubers have been spaced 9 inches to 12 inches apart, instead of the wider 12 inches to 18 inches usually practised in the southern districts. As the yield per plant in the winter crop is apparently not reduced by the closer spacing, this method is valuable where small areas are under cultivation, particularly when irrigation facilities are available.

Fertilizer trials conducted on average soils have not shown any marked increase in yields, but further experimental work is necessary before a definite recommendation can be made. However, crops grown on the poorer soils, particularly of old cultivations, should benefit from substantial applications of phosphoric acid and potassic fertilizers.

As heavy rains are likely to be experienced at this period of the year, well-drained, free-working soils are to be preferred. Deep ploughing will be found to assist drainage, besides providing more favourable growing conditions.

If seed potatoes are purchased from outside sources, preplanting treatment with hot formalin or acid corrosive sublimate may be desirable.

Although cut tubers are permissible for spring planting, seed for the autumn crop should definitely comprise whole tubers only.

Attention is also directed to the control of Irish blight and other diseases by means of suitable sprays, full particulars of which may be obtained on application.—W. R. Straughan, Instructor in Agriculture.

Plate 141.

The Road Through the Rain Forest.

A scene on the way from Mount Ossa to Kungurri, Queensland.

Silage.

A. E. GIBSON, Director of Agriculture.

SILAGE is the term given to green forage that has been preserved in such a way that it retains its succulence, palatability and, to a certain extent, its digestibility over an extended period.

Success in silage making depends chiefly on the exclusion of air from the material, which, in its processing, undergoes fermentation to a greater or lesser degree, during which the carbohydrates—such as sugars and starches—undergo certain changes and are reduced in value. Similarly, the proteins are reduced and acids—such as lactic and acetic —are formed; while, in the case of inferior silage, butyric acid is present. The exclusion of air from silage has the effect of reducing fermentation. In order to facilitate fermentation, weighting material is used, either by mechanical means or of stone, concrete blocks, heavy wood, or soil. The last mentioned is, however, the least satisfactory of all as a weighting material, for it becomes more or less mixed with the silage.

Although it is possible to utilise a variety of green materials for silage, naturally the best results are obtained by using the best class of fodders. Lucerne, which, without doubt, is the best class of material for hay making, does not lend itself to processing as silage; although it may be utilised to advantage, if combined with fodders such as maize or sorghum, when these two materials have reached a more mature stage than that considered necessary for the production of a good class of silage. Legumes, generally speaking, cannot be recommended for use for silage, unless mixed with some other material having a higher percentage of fibre in its composition.

The most suitable summer crops for silage purposes are in order of preference: Maize, sorghums, millets, setaria species (panicums). The winter cereals—preferably a combination of barley, oats, and wheat, with a mixture of peas or vetches, sown in equal quantities at the rate of 60 lb. per acre of the mixture—form a valuable silage material. In harvesting, however, they require to be handled with a reaper and binder in preference to a mower.

The stage of maturity at which a crop is harvested for ensiling has a distinct bearing also on the quality of silage produced. Maize harvested when the cobs have just reached the glazed stage, but, in which the grain still contains more or less milky substance, produces material having that pleasant acid smell which is associated with good silage and is light brown or yellow-brown in colour. Fermentation occurs usually when the temperature of the material is between 104 and 112 degrees Fahr. Sorghums, when harvested at the period at which the seed has been formed and is in the dough stage, produce good quality silage; but, owing to their high saccharine content, fermentation is more pronounced and a higher temperature is reached than in the case of those crops in which the sugar content is lower. Sorghum silage is dark brown to black in colour according to the temperature above 115 degrees Fahr. at which fermentation usually takes place.

Silage produced from crops having an excess of moisture, due to immaturity at harvesting, has an unpleasant odour on account of the presence of butyric acid and is not relished by live stock. Musty and

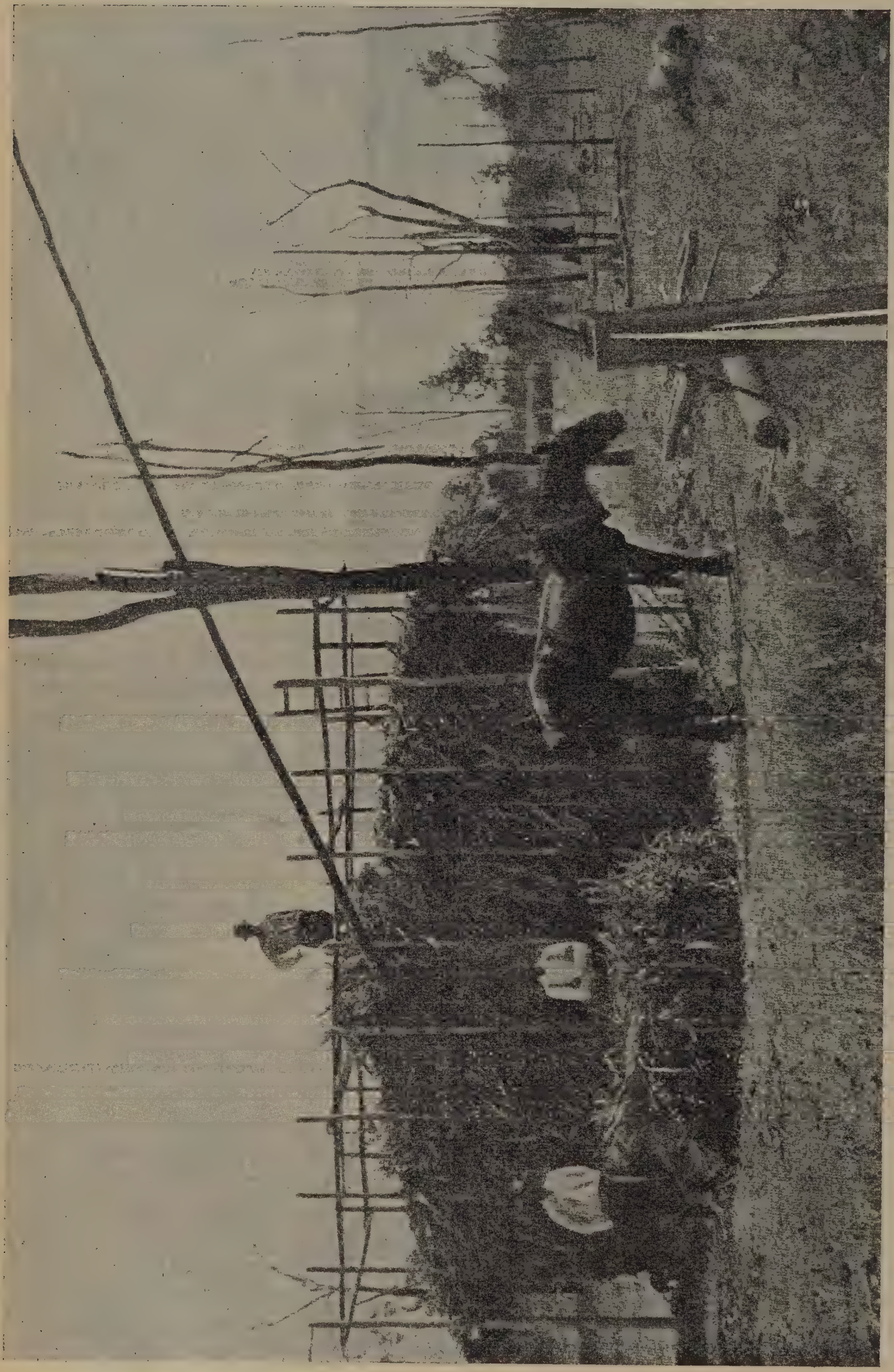


Plate 142.

Stack in course of construction, showing projecting "untrimmed ends," also "whip" hoist attached by means of a chain to a dead tree.

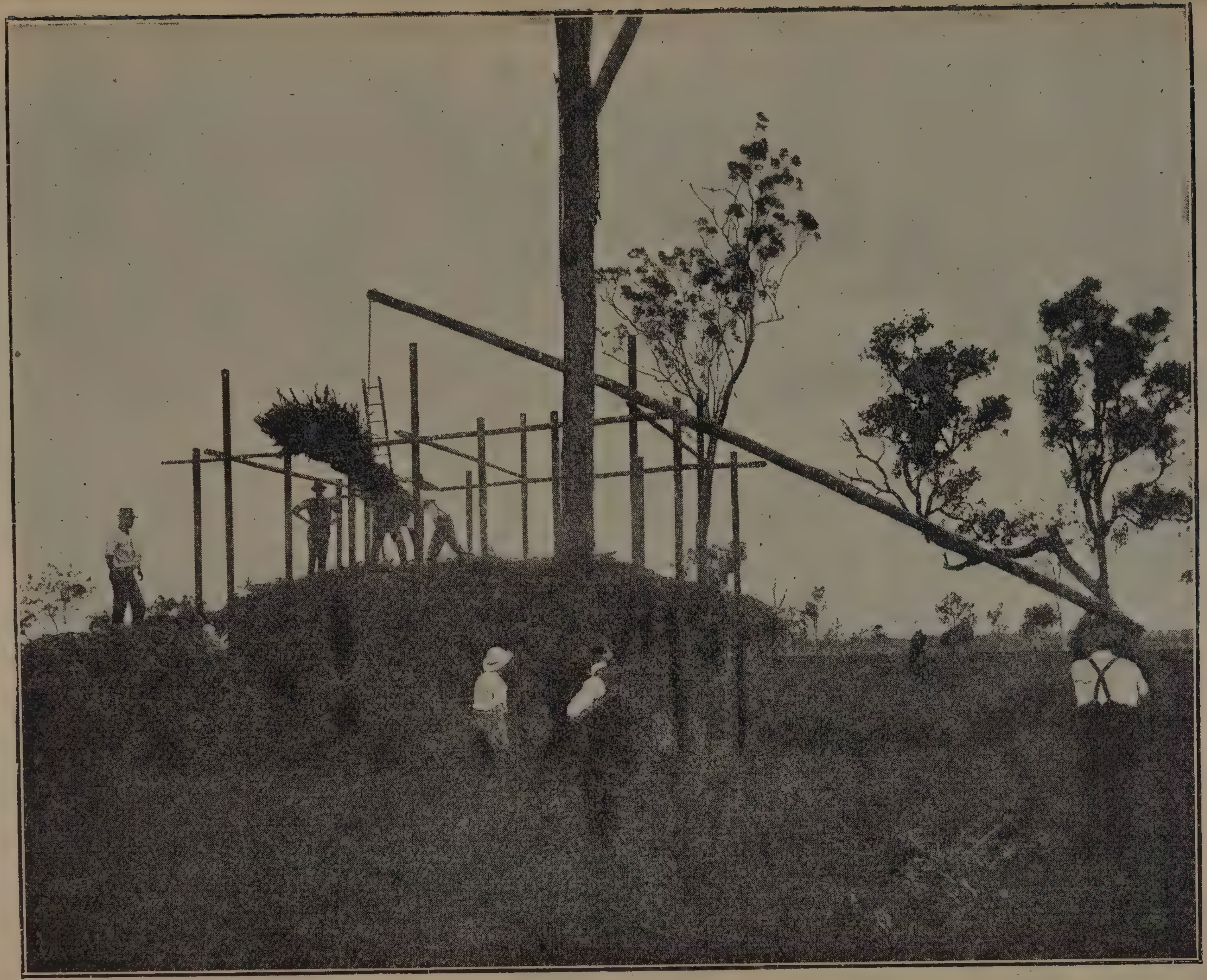


Plate 143.
Building a Silage Stack on a Lockyer Farm.

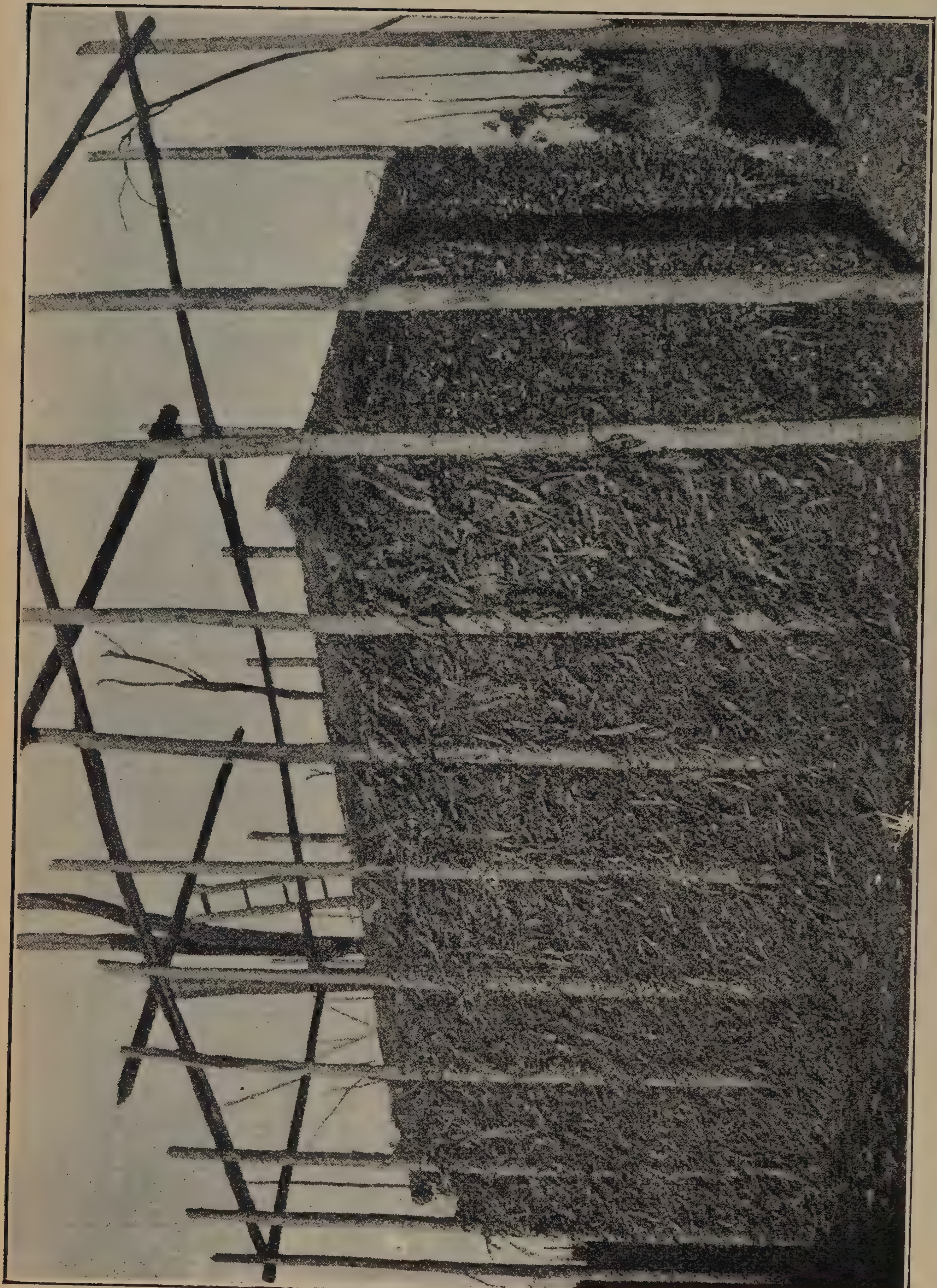


Plate 144.

Framework and "trimmed" stack, showing an extra pair of uprights at each end, to which a crosspiece is attached for supporting the ends of the fodder when stacking.

mouldy silage, on the other hand, is caused by the ensiling of material which is too dry for the purpose. It is sometimes noticeable in silos where neglect to remove dried-out material during a cessation in filling operations, or where air has had access to silage in the vicinity of doors which are not airtight.

During periods of drought the demand for information on silage in all its phases encourages the hope that an increased production of fodder crops for conservation in that form will follow the return to normal conditions. Unfortunately, however, a spirit of optimism based on a belief in a continuity of good seasons often persists, and, consequently the necessity for providing for lean years is relegated to the limbo of things forgotten.

Arguments in favour of hay in preference to silage are frequently advanced, but when farmers consider that hay loses at least 75 per cent. of its weight in the stack whilst silage loses no more than 15 per cent. the case for hay is considerably weakened. Again, lucerne—the most popular fodder used for hay—is of much higher monetary value during periods of drought than wheat or oaten hay, due, of course, to its higher nutritional value. When used as fodder for dairy cattle during periods of drought, however, the economic value of lucerne compared with silage on a tonnage basis is distinctly in favour of silage, consequently the dairy farmer who can conserve fodder in the form of maize silage at a cost of 12s. a ton, with a loss of only 15 per cent., is in a much better position than the man who conserves lucerne at a value of, say, £5 a ton, and loses 75 per cent. of weight of green material in so doing.

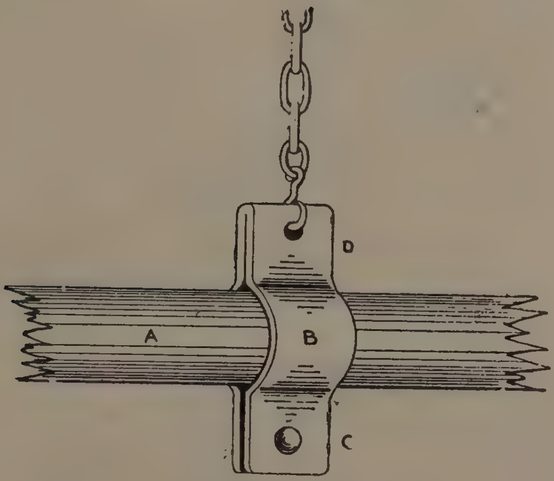


Plate 145.

Clamp for Suspending Whip.—(*a*) Whip spar. (*b*) Clamp made from an old tyre 4″ × ⅝″. (*c*) Clamping bolt. (*d*) Clamp welded and bored for hook.

That both summer and winter growing fodders can readily be conserved in the form of stack silage is generally conceded, and provided that care and attention is given in regard to stacking and covering sufficiently from weather influences, no reason exists why the resultant silage should not keep good for at least two or three years without any serious depreciation. The literature issued by the Department entitled "Some Notes on Silage," "Silos and Silage," is available to those who contemplate ensiling operations, and a careful perusal is advised.

Enquiries which reach the Department relative to type of silo deal invariably with the underground type in preference to the overhead type. It is somewhat difficult to understand why the ideas of

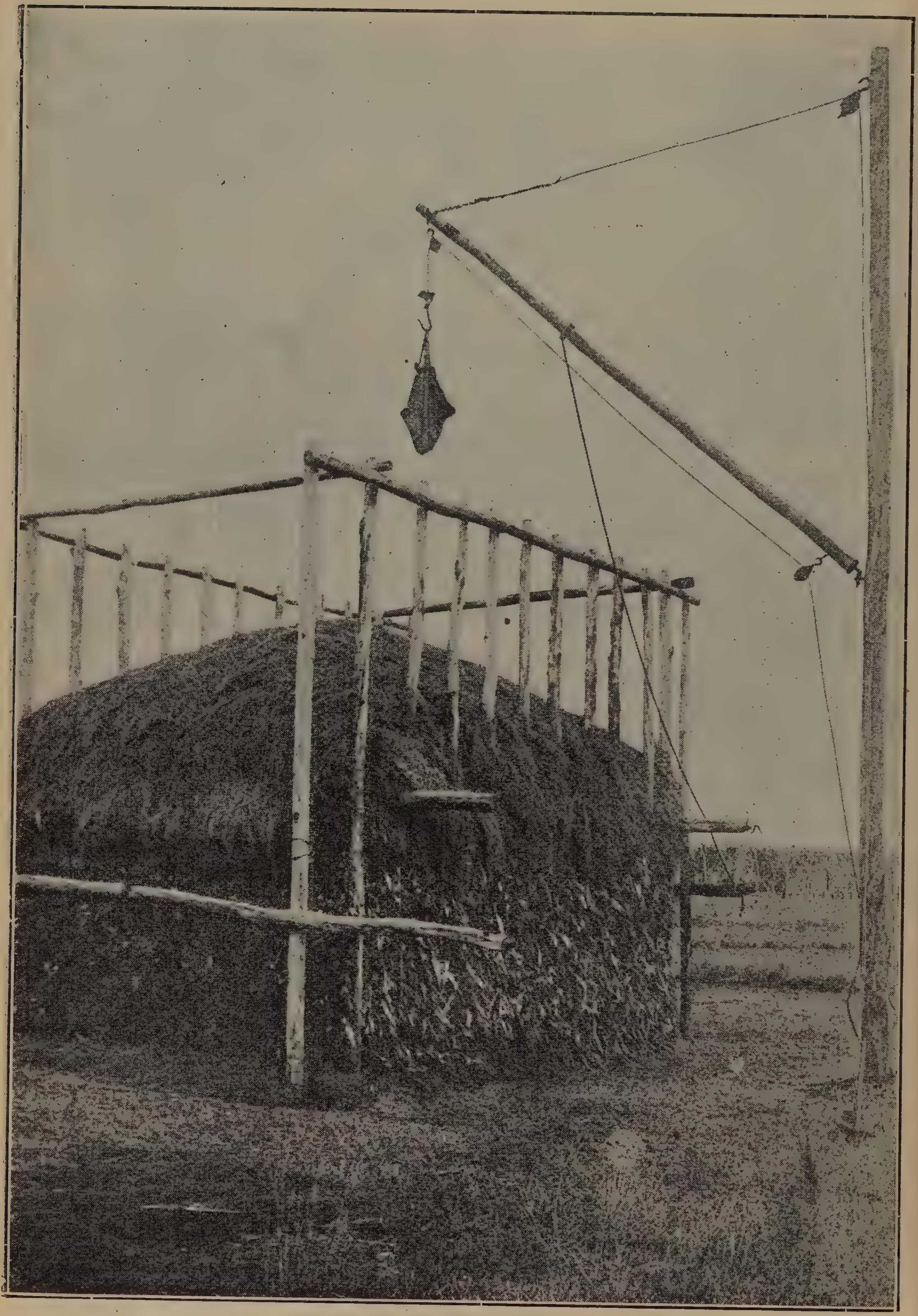


Plate 146.

A Silage Stack on a Central Burnett Farm.

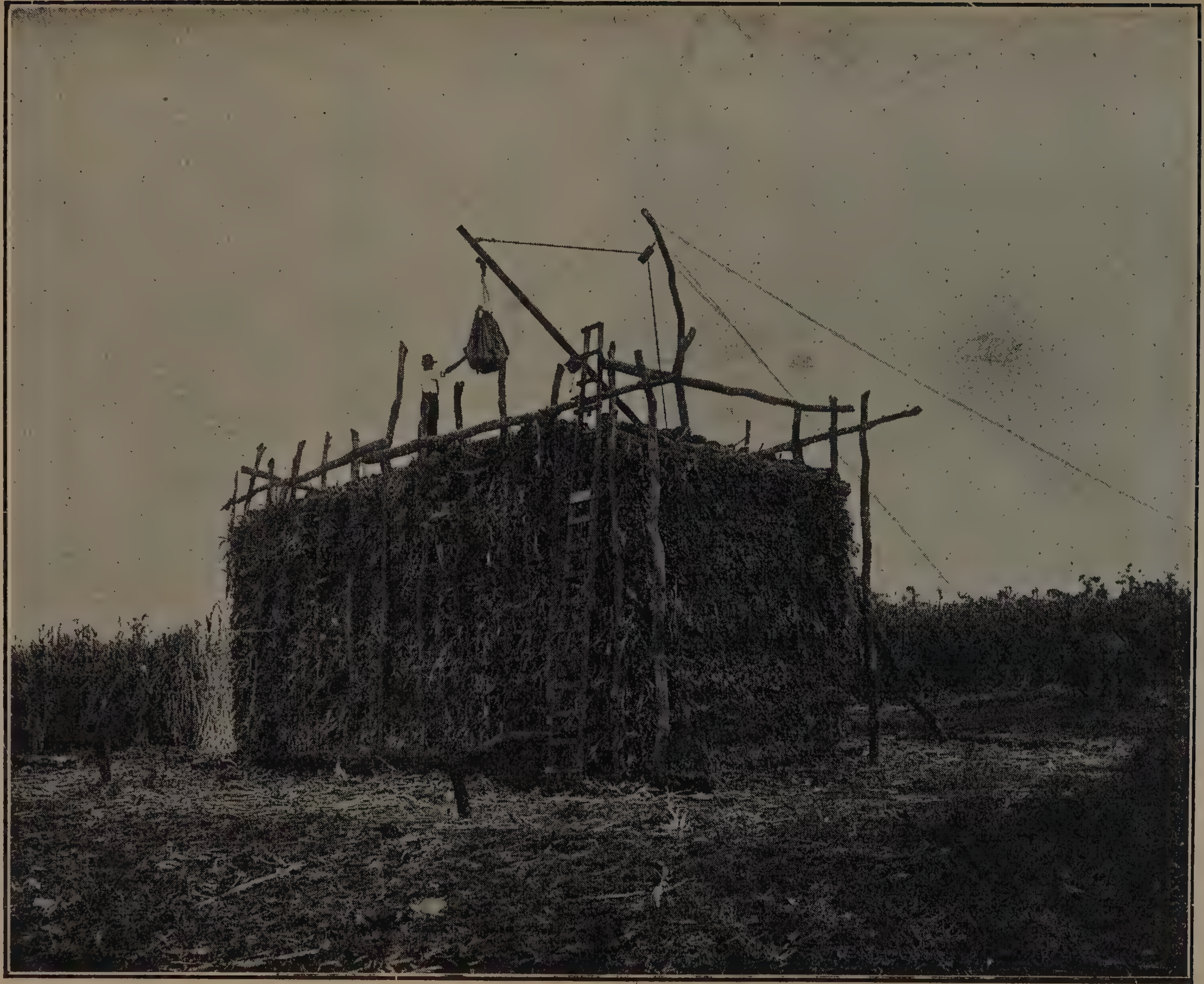


Plate 147.

Stack on the Darling Downs nearing completion. Weighting material (stones) being hoisted by a horse prior to the topping off of the stack with bush hay.

those who are inclined towards silage conservation should run in the direction of pits instead of overhead structures. It would appear that the ease with which the underground silo can be filled quite overshadows the difficulty of emptying it. To those who are lacking in silage experience, it is suggested that the stack method should be adopted and later on, when they have experienced the benefits that accrue from the use of silage as a fodder, that earnest consideration be given to the erection of a silo of a suitable type.

When it is considered that no technical difficulties surround the conservation of fodder in the form of ensilage the question is asked: Why do stockowners as a rule sidetrack silage making? As maize or sorghums are usually the crops chosen, it has been suggested that the work of handling what is naturally weighty material is regarded as somewhat laborious, apart from which a good deal of hand work is entailed. The correctness of this is admitted, but, at the same time, the opinion is expressed that if similar methods of harvesting maize and sorghums for silage were utilised in the case of such crops as oats, wheat, or barley, little if any of the latter crops would be grown. In these days of improved methods retrogression in harvesting practices is not economically sound, yet many of our potential fodder conservationists give no consideration to this aspect of the question, while holding very definite opinions on the merits of the various types of silos. Might it be suggested that if greater consideration were given to labour-saving methods and machinery silage conservation would be practised more widely than it is at present? For example, consideration might be given to:—

(*a*) The use of maize harvesting machinery;

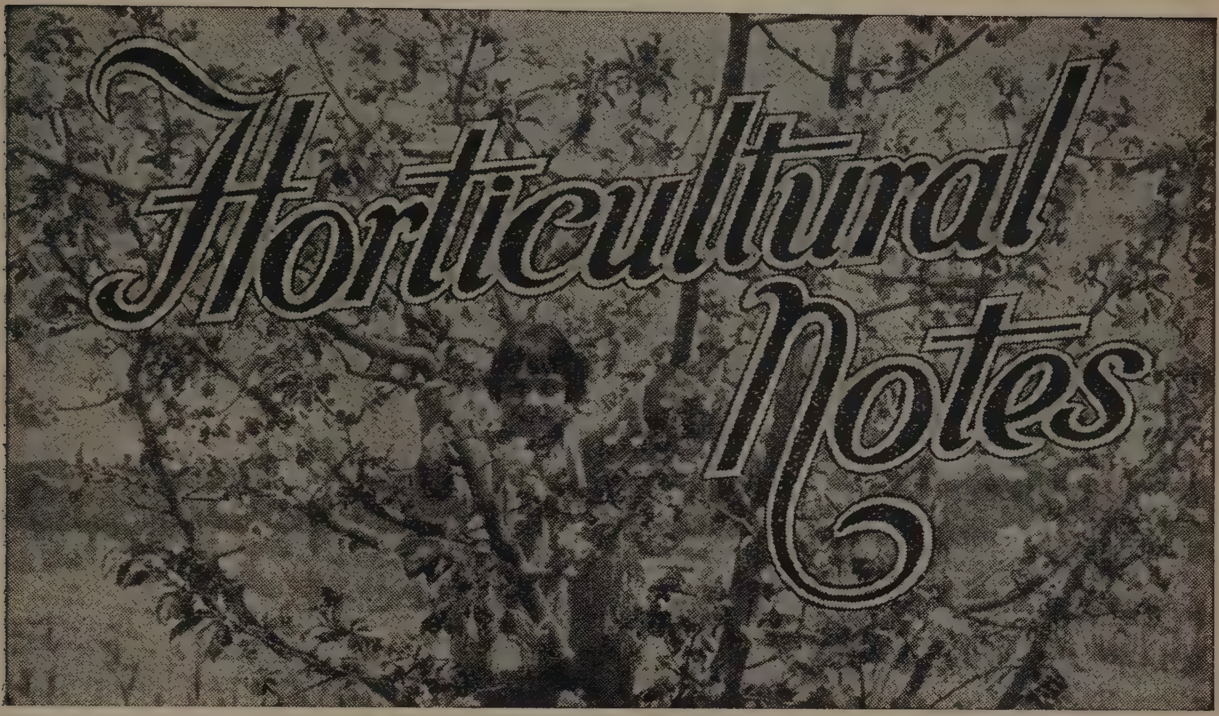
(*b*) Utilisation of tabletop lorries, mounted on motor-car types of wheels;

(*c*) The building annually of silage stacks.

With regard to (*a*) it is suggested that neighbourly co-operation would reduce the individual cost of the maize harvester, which is obtainable in Queensland at £84.

(*b*). Loading green maize on drays or waggons of the ordinary type wastes a considerable amount of human energy, whereas the handling on to low table-topped waggons is comparatively easy. Sets of motor wheels are procurable from most dealers, and are readily adaptable for purposes of farm transport, while they have the further advantage of considerably reducing draft.

(*c*). That silage stacks are recommended does not necessarily mean that silos are looked on with disfavour, but emphasis is certainly placed on the necessity of possessing harvesting or transporting machinery and utilising the stack method in preference to having an expensive silo and only crude or laborious methods of filling it. The advantages (monetary and otherwise) that will accrue from the former will ultimately be a guide and of assistance when it is found necessary to adopt the silo in preference to the stack method—with the added possibility that it may not be necessary to go beyond one's current banking account in order to finance such a project.



Composition of Some Fruits and Fruit Waste.

E. H. GURNEY, A.A.C.I., Agricultural Chemist.

AS requests have frequently been forwarded to the Department for information concerning the composition of fruits and fruit waste, analysis of some fruits appearing on the market have been made, and these analyses are given in attached tables.

According to nature of season it is possible that some variation in composition of the different fruits may occur, and for this reason further analyses will be undertaken of fruits in season and also analyses of fruits not listed.

In connection with the attached tables of analyses, it must be understood that the first column refers only to the weight of sample submitted for analysis, and not to the average weight of fruit that may have been upon the market throughout the season.

The samples which were analysed were fruits already on the market, and hence all were available for public purchase. Some of the fruits had not reached the full stage of ripeness and, therefore, a rather higher acidity may be shown than would be the case with fully matured fruits.

It may be observed that the sucrose content (cane sugar) of some fruits is much lower than in others.

Fruits are valuable as an item in the diet on account of the presence of sugars which are easily digested. Fruit flavours are also stimulants to the appetite, while fruits contain some of the vitamins necessary for good health.

Analyses of the Edible Portion of Some Queensland-grown Fruits.

Fruit and Variety.	Average Weight in Grammes.	Edible Portion. (Per Cent.)	Skins. (Per Cent.)	Seeds. (Per Cent.)	Moisture. (Per Cent.)	Ash. (Per Cent.)	Protein. (Per Cent.) (N x 6·25.)	Per Cent. Sugars. Reducing Sugars as Glucose. (Per Cent.)	Per Cent. Sugars. Sucrose. (Per Cent.)	Refractive Index of Juice at 28° C.	Total Solids in Juice by Refractive Index. (Per Cent.)	*Fibre by Sugar-cane Method. (Per Cent.)	Acidity, 100 Grammes of Fruit contain the Equivalent of Grammes H_2SO_4.	pH.	Remarks.
Plums, var. Wilson ..	17·9	91·5	..	8·5	86·4	0·44	0·36	3·61	3·96	1·3500	11·93	0·70	0·92	3·65	Not quite ripe. Flesh hard. Fairly sweet. Slightly tart at seed.
Pawpaw	868·0	74·3	12·0	13·7	89·7	0·50	0·53	7·26	Nil	1·3460	9·38	0·91	0·07	5·63	One large and one small fruit. Both about half coloured.
Cherries (Black), var. ..	7·58	93·07	..	6·93	73·4	0·71	2·09	13·23	0·13	1·3619	19·50	4·3	0·45	4·03	..
Cherries (White) var. ..	4·94	91·08	..	8·92	83·5	0·61	0·96	10·45	0·48	1·3530	14·00	3·2	0·74	3·77	..
Peaches	110·6	91·4	..	8·6	87·6	0·55	0·84	1·91	5·78	1·3478	10·58	1·74	0·61	3·73	..
Apricots	48·8	91·8	..	8·2	87·2	0·66	0·83	1·56	5·73	1·3489	11·33	1·38	0·84	4·60	..
Plums, var. Burbank ..	67·2	95·53	..	4·47	89·4	0·42	0·56	2·22	6·32	1·3496	11·75	1·37	1·11	3·41	Some soft, with a sweet insipid taste. Some firm. Tart taste.
Plums, var. Black Diamond	55·7	92·57	..	7·43	87·0	0·47	0·45	4·08	4·76	1·3526	13·70	1·91	0·94	3·04	A few soft, with a slightly tart taste. Others firm; very tart taste.
Bananas, var. Sugar ..	60·5	73·2	26·8	..	69·4	1·10	1·43	18·45	2·99	..	..	4·45	0·47	4·57	..
Bananas, var. Cavendish	142·5	66·2	33·8	..	72·8	0·99	1·16	10·46	8·17	..	..	2·30	0·20	4·71	..
Bananas, var. Ladies' Finger	96·3	70·0	30·0	..	64·3	0·87	0·98	19·10	2·26	..	..	8·90	0·34	4·54	..
Passion Fruit	29·2	54·8	45·2	10·5	71·1	0·70	2·39	5·14	4·18	1·3567	16·30	14·16	2·13	3·26	Edible portion includes seeds.
Figs	27·1	85·4	14·6	..	82·3	0·37	0·71	13·92	0·35	1·3570	16·50	1·33	0·15	4·80	Edible portion includes seeds.
Persimmons	142·0	100·0	..	..	83·7	0·34	0·29	10·98	..	1·3530	14·02	..	0·07	6·80	Analysis of whole fruit; seedless.
Mango	259·8	63·7	20·1	16·2	87·39	0·35	0·36	4·93	4·22	1·3491	11·46	1·04	0·09	4·53	..
Pears, var. Parker's Triumph	156·8	96·12	Skins & Seeds	= 3·88	83·4	0·31	0·30	8·57	0·35	..	..	3·09	0·06	4·78	On the market, but immature.
Pears, var. Rome Beauty	164·7	92·60	Skins & Seeds	= 7·40	83·7	0·35	0·36	7·62	3·38	..	..	3·19	0·42	3·32	On the market, but immature.
Pears, var. William ..	112·7	94·7	Skins & Seeds	= 5·3	81·9	0·28	0·32	8·38	0·70	..	..	3·67	0·06	4·95	On the market, but immature.
Apples, var. Delicious ..	122·0	92·9	Skins & Seeds	= 7·1	81·2	0·28	0·19	10·68	2·06	..	..	3·09	0·13	4·05	On the market, but immature.
Egg Fruit	532	92·3	7·7	Trace	93·7	0·40	0·71	2·68	0·09	1·3379	3·98	2·5	0·06	4·90	..
Jack Fruit	8 lb.	53·9	29·8	5·1	67·1	3·40	2·0	17·38	2·27	..	..	4·05	0·46	5·0	Inedible centre 11·2 per cent.

* The method of determining fibre is the standard method adopted in Queensland sugar mills.

Analyses of Seeds, Skins, &c., of Some Queensland-grown Fruits.

Sample.	Whole Fruit. (Per Cent.)	Whole Seed. (Per Cent.)	Moisture. (Per Cent.)	Ash. (Per Cent.)	Protein. (Per Cent.)	Fat. (Per Cent.)	Fibre by Acid-alkali Method. (Per Cent.)	Carbo-hydrates. (Per Cent.)	SUGARS.		Lime CaO. (Per Cent.)	Phosphoric Acid. P_2O_5. (Per Cent.)	Potash. (Per cent.)	Hydrocyanic Acid.	Remarks.
									Reducing Sugars as Glucose. (Per Cent.)	Sucrose. (Per Cent.)					
Wilson Plum Seed Shells	7·0	82·4	17·7	0·94	..	..	57·4	..	..	..	0·07	0·02	0·05	..	..
Wilson Plum Seed Kernels	1·5	17·6	20·0	1·71	19·49	28·76	10·2	19·84	..	..	0·256	0·67	0·31	+	..
Cherry Seed Shells ..	7·17	90·0	10·7	2·0	2·1	..	59·3	..	..	..	0·56	0·216	..	..	..
Cherry Seed Kernels ..	0·80	10·0	13·1	4·5	28·6	22·5	..	..	..	..	0·064	1·306	..	..	..
Peach Seed Shells ..	8·6	..	10·4	1·6	1·2	..	62·5	..	..	..	0·28	0·161	..	..	..
Peach Seed Kernels ..		..	11·0	5·5	24·1	42·4	..	..	..	..	0·18	1·074	..	+	..
Apricot Seed Shells ..	6·15	75·0	11·4	1·68	1·1	..	49·0	..	..	..	0·49	0·183	..	..	..
Apricot Seed Kernels ..	2·05	25·0	7·6	3·6	25·6	75·8	..	..	..	..	0·14	1·410	..	+	..
Sugar Banana Skins ..	26·8	..	85·4	2·6	2·6	0·7	1·9	6·8	6·14	Nil	0·017	0·158	..	..	..
Ladies' Finger Banana Skins	30·0	..	87·7	2·0	0·9	0·9	1·9	6·6	5·51	0·26	0·082	0·111	..	..	..
Cavendish Banana Skins	33·8	..	90·0	2·6	1·1	0·4	1·5	4·4	3·33	0·66	0·027	0·072	..	..	..
Passion Fruit Skins ..	45·2	..	81·7	1·9	1·9	0·2	7·3	7·0	..	..	0·060	0·032	..	..	..
Passion Fruit Seeds ..	10·5	..	..	..	8·49	..	..	..	Nil	..	..	..	..	..	..
Fig Skins	14·6	..	76·3	0·7	1·5	0·5	2·3	18·7	..	..	0·162	0·055	0·233	..	..
Mango Skins	20·1	..	79·3	0·60	0·90	0·3	3·1	15·8	..	..	0·085	0·044	0·393	..	..
Mango Seeds Outside Husk	8·12	50·1	6·46	2·1	0·3	0·5	50·3	38·3	..	..	0·246	0·111	0·724	..	..
Mango Seeds, Parchment-like Covering of Kernel	0·32	2·0	6·73	1·8	20.2	..	50·25	..	..	..	0·337	0·123	0·402	..	..
Mango Seed Kernel ..	7·76	47·9	8·0	3·1	6·0	7·8	5·6	69·5	..	..	0·224	0·421	..	..	..
Jack Fruit Skin	29·8	..	60·1	2·83	2·79	1·87	7·58	24·86	..	..	0·17	0·13	..	..	..
Jack Fruit, Centre ..	11·2	..	80·8	3·27	1·75	0·58	3·33	10·29	..	..	0·090	0·105	..	..	..
Jack Fruit, Seeds.. ..	5·1	..	48·8	1·59	6·04	0·05	4·40	39·12	..	..	0·085	0·275	..	..	..

Granadilla Packing.

JAS. H. GREGORY, Instructor in Fruit Packing.

THE granadilla, like most tropical fruits, is of a soft nature when ripe, and it is therefore necessary to exercise great care in the harvesting and packing of this fruit. Owing to the large size of the fruits, the loss of even one in a packed case would be considerable. Maturity and size have to be taken into account to ensure successful marketing.

Maturity.

It can be safely said that the greatest fault found on the inspection of granadillas at the markets is that of immaturity. Most growers appear to be afraid to permit the fruit to mature on the vines, yet the writer procured fully matured, coloured, but firm, specimens of the fruit in Cairns during a warm period in the month of May and carried them in a handbag to Townsville, where they ripened perfectly, and were consumed ten days later. Experimental consignments packed on the lines indicated in this booklet travelled from Cairns to Brisbane, and kept in sound condition for fourteen to twenty days, and then ripened satisfactorily.

When matured the fruit loses its white, and with some varieties its green, appearance, taking on a golden green colour at the end, and this is the correct stage at which to remove the fruit from the vine for long-distance transport. For local marketing the golden colour should be allowed to cover the whole of the fruit before it is removed from the vine. Where there is danger of fruit fly attacks, the fruits can be protected until fully mature by placing paper bags over them.

Harvesting.

All fruit should be clipped to remove it from the vine, and should be gently placed in baskets or picking-boxes for removal to the packing-shed. Only a short length of stalk should be left attached to each fruit.

Packing-shed Equipment.

It is advisable to provide a flat-topped table on which to spread out the fruit to cool; the table should have a raised edge to prevent any fruits from rolling off. Covering the top of the table with a thin padding of bagging or similar material is advantageous in obviating many skin abrasions.

Whilst handling the fruit on to the table it can be sized into various sizes suitable for the different packs.

Containers.

The tropical fruit case, 24¾ inches long by 12 inches wide, by 12 inches deep is a suitable container. Of the bushel cases tried, the standard case, 18 inches long by 11½ inches wide, by 10½ inches deep, has been found to be by far the most suitable type of this size of container, and is strongly recommended for general use.

Packing Materials.

Woodwool is recommended as the most suitable material for padding purposes. Grass is unsatisfactory owing to its tendency to develop damp and heat in transit. This causes premature ripening of fruit. White or coloured plain paper for wrapping the fruits, and corrugated cardboard for lining the boxes and giving added protection to the fruit, are also necessary.

Packing.

Protection is the keynote of successful granadilla packing. The cases are first prepared by placing corrugated cardboard sheets on the bottom and sides, with the corrugated side to the wood, and a layer of woodwool is placed on the bottom. Each fruit is then rolled in plain paper and placed upon the woodwool until a complete layer is formed. The layer of fruit is then covered with woodwool, which is also placed in the crevices between the fruits. Another layer of wrapped fruit is then placed in the case, and alternate layers of woodwool and fruit until the case is filled. A study of the packing table will give the number of layers required to fill the case.

When packing the fruit care should be taken to always place the stalk end of the fruit to the wood of the box in order to give maximum protection to the flower end of the fruit, which softens first.

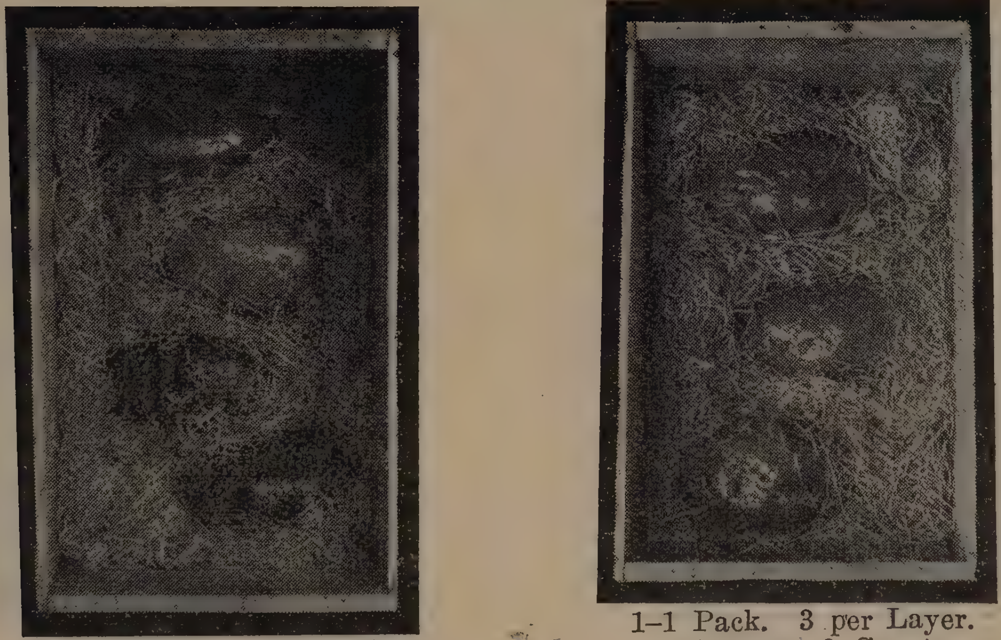
It will be noticed that there are two different types of packs, across the case, and from end to end. See Plate 149 and compare with other packs.

STANDARD BUSHEL CASE.

18 inches long x 11½ inches wide x 10½ inches deep.

First Layers.

Packed Across.



1—1 Pack. 4 per Layer.
3 Layers. 12 Count.

1–1 Pack. 3 per Layer.
3 Layers. 9 Count.
Note spacing of fruit.

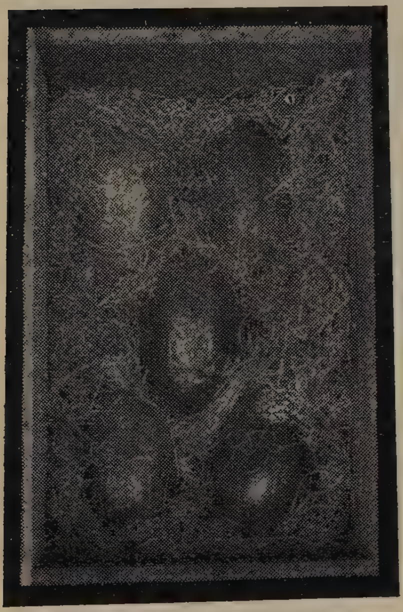
Note how to space fruit slightly apart to permit the layers to fit into each other and come to the correct height in the case. Pad well between each fruit.

Plate 148.

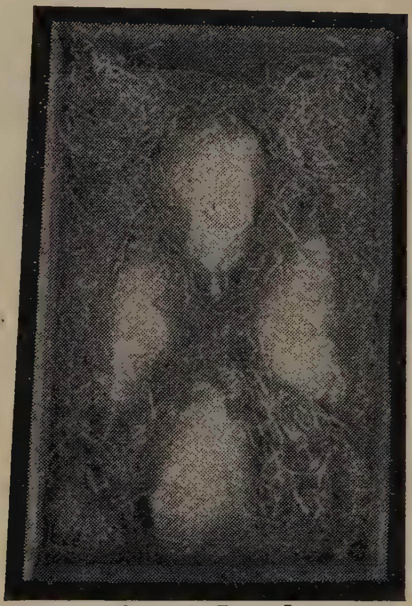
STANDARD BUSHEL CASE.

18 inches long x 11½ inches wide x 10½ inches deep.

Packed endways.



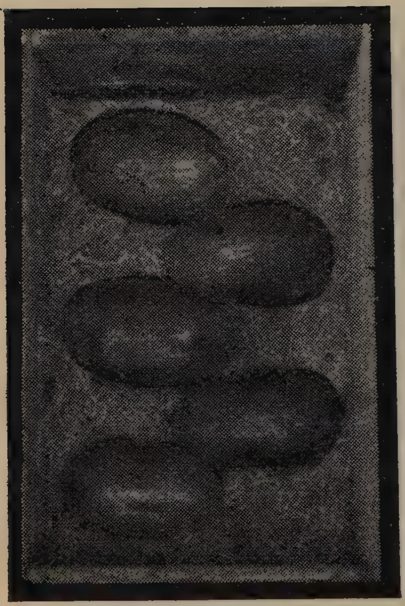
First and Third Layers. Fruit Unwrapped to show method of placing.



Second and Top Layers. Fruit Wrapped for Market.

4 Layers to Case. 2 Layers of 5. 2 Layers of 4. 18 Count.

Plate 149.



1–1 Pack. 5 per Layer. 3 Layers. 15 Count.

Finishing Packing the Standard Case.

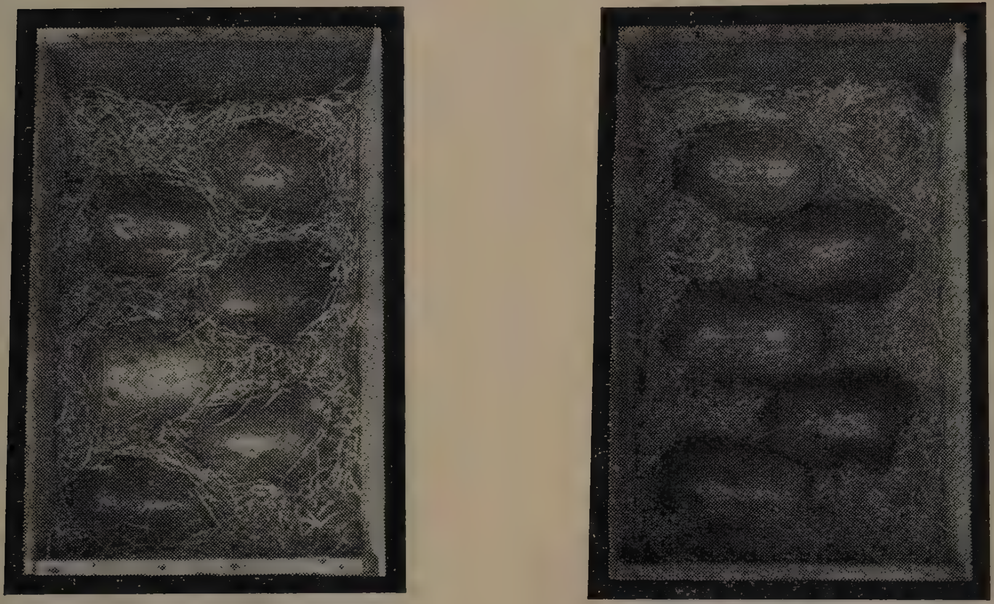
Showing a finished case. Completed by placing a layer of woodwool on the top. In this case the woodwool is removed to show method of wrapping fruit.

Plate 150.

STANDARD BUSHEL CASE.

18 in. long by 11½ in. wide x 10½ in. deep.

First Layer Packed Across.

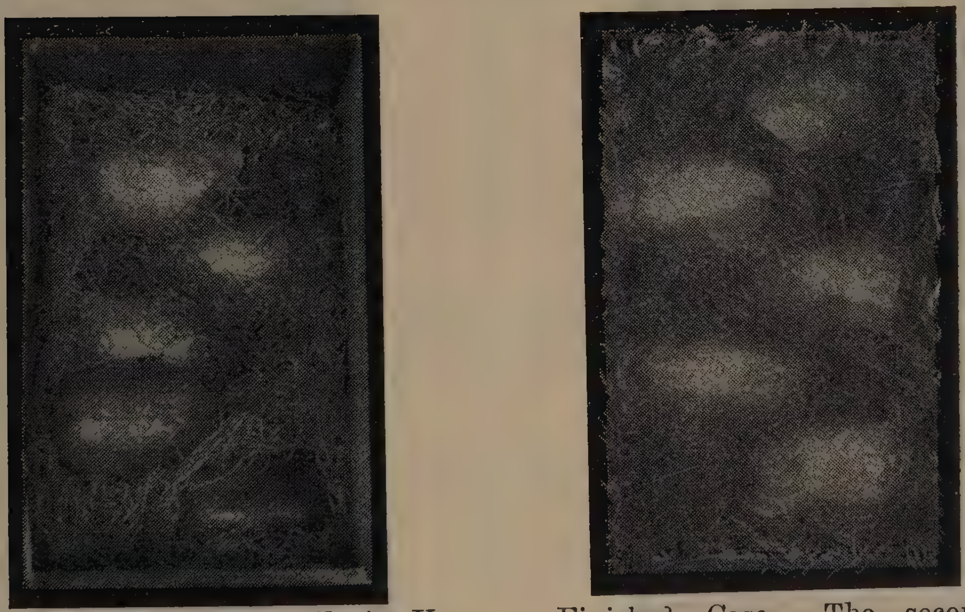


6 per Layer. 4 Layers. 24 Count.

First and Third Layers. 5 per Layer. 4 Layers. 20 Count.

Plate 151.

Packed Across the Case.



Start of Second Layer. Fruit Unwrapped. First Layer. Fruit Wrapped.

Finished Case. The second layer is placed the same way as the top layer.

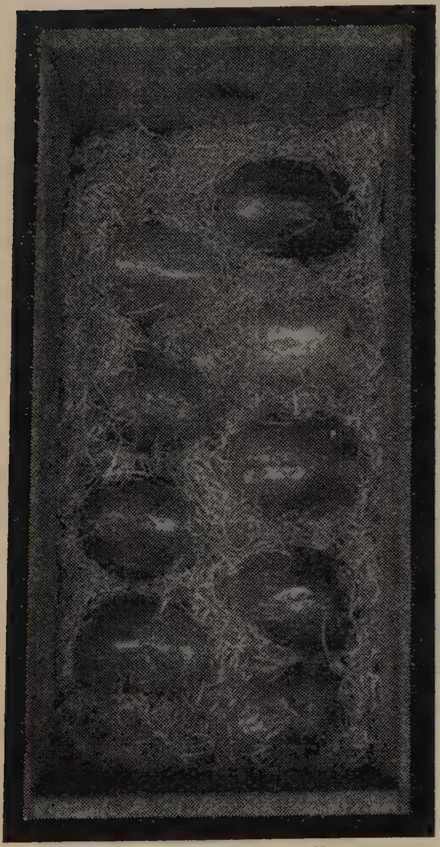
1–1 Pack. 5 per Layer. 4 Layers. 20 Count.

Plate 152.

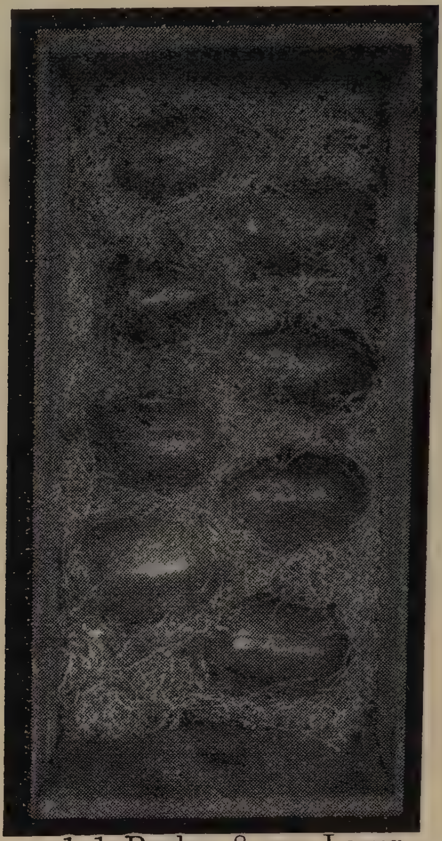
THE TROPICAL FRUIT CASE.

$24\frac{3}{4}$ inches long x 12 inches wide x 12 inches deep.

1–1 Pack Across.

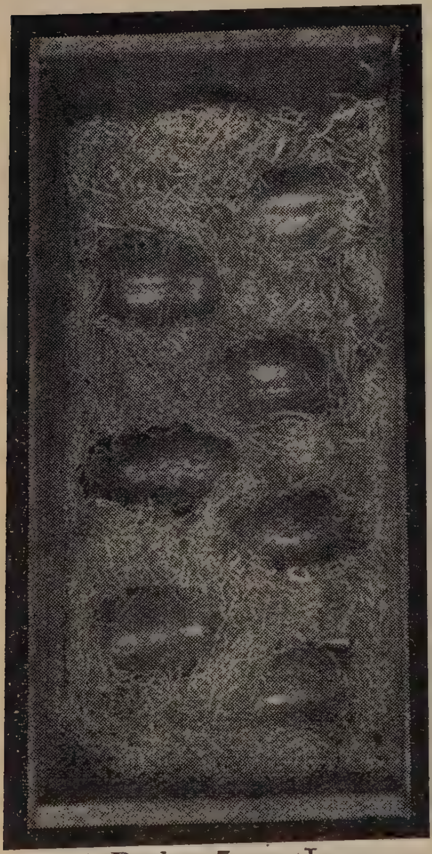


1–1 Pack. 9 per Layer.
4 Layers. 36 Count.

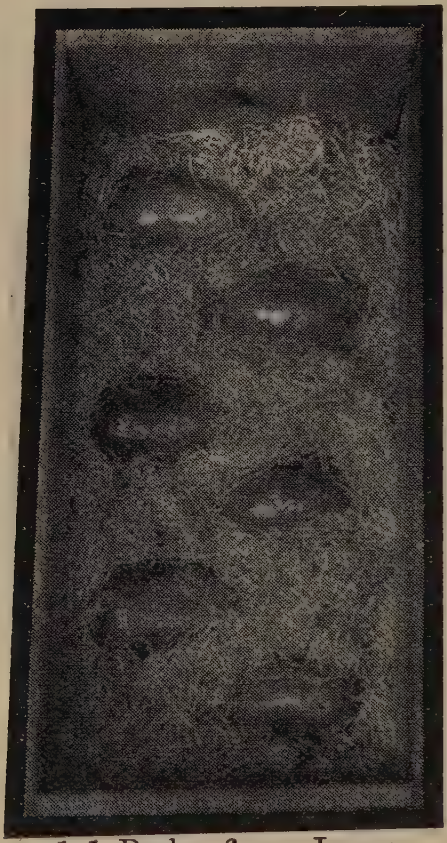


1–1 Pack. 8 per Layer.
4 Layers. 32 Count.

Plate 153.



1–1 Pack. 7 per Layer.
4 Layers. 28 Count.



1–1 Pack. 6 per Layer.
4 Layers. 24 Count.
The first row of the 21 pack is placed the same as this, but the fruit is larger.

NOTE.—In counts 28 and 24 the fruit is spaced to permit the other layers to fit down better and so prevent the fruit coming too high in the case.

Plate 154.

THE TROPICAL FRUIT CASE.

24¾ inches long x 12 inches wide x 12 inches deep.

2—1 Pack. Endways.

2–1 Pack. 6 per Layer.
3 Layers. 18 Count.

2–1 Pack. 2 Layers of 5.
1 Layer of 4. 14 Count.

Plate 155.

GRANADILLA PACKS.

Tropical Case—24¾ in. long x 12 in. wide x 12 in. deep.

Approximate Average Size (Diameter).	Pack.	No. in each Layer.	No. of Layers.	Total.	Remarks.
3⅞ inches ..	1—1	9	4	36	Pack Across
4 " ..	1—1	8	4	32	Pack Across
4¼ " ..	1—1	7	4	28	Pack Across
4½ " ..	1—1	6	4	24	Pack Across
5 " ..	1—1	7	3	21	Pack Across
5¼ " ..	2—1	6	3	18	Pack Endways
5½ " ..	2—1	2 layers of 5 1 layer of 4	3	14	Pack Endways

Standard Case—18 in. long x 11½ in. wide x 10½ in. deep.

Approximate Average Size (Diameter).	Pack.	No. in each Layer.	No. of Layers.	Total.	Remarks.
3⅞ inches ..	1—1	6	4	24	Pack Across
4 " ..	1—1	5	4	20	Pack Across
4¼ " ..	2—1	2 layers of 5 2 layers of 4	4	18	Pack Endways
4½ " ..	1—1	5	3	15	Pack Across
	1—1	4	3	12	Pack Across
	1—1	3	3	9	Pack Across

Acknowledgment.—Thanks are due to all growers and fellow officers who assisted in making available fruit and facilities for packing and photographing.

Passion Fruit Growing on the South Coast.

J. McG. WILLS, Fruit Branch.

[*Continued from page 332, March, 1937.*]

PREPARATION OF THE LAND.

THE thorough preparation of the land in which passion fruit vines are to be planted is essential in order that the young plants may establish themselves rapidly and develop a root system that can traverse a greater area from which to draw available plant food. No after cultivation will produce equal results. Wherever ploughing is possible the land should be ploughed deeply and worked into a fine tilth.

On land where ploughing is not possible the soil should be broken up by hand, mattocks or steel pronged forks being used for this purpose. On forest land, where hardwood stumps do not rot quickly and cost of stumping is very high—also on slopes too steep for the use of horse-drawn implements—the preparation and subsequent cultivation must all be done by hand.

Unburnt logs placed across the slope of the land will to some extent prevent surface soil erosion. Where the surface is stony time expended in placing the stones in lines at regular intervals across the slope will be regained many times in subsequent chippings. The preparation should help in the retention of surface soil and be completed by the end of August, as the land will then be in a condition to absorb any rain that falls. Planting out the young seedlings can be commenced in spring time with every prospect of them becoming quickly established in their new location.

As our coastal soils are acknowledged to be deficient in lime an application of lime at the rate of from ½ ton to 1 ton per acre would be an advantage. The lime will assist in correcting any acidity in the soil, hasten the decay of organic matter, render plant food more readily available, and improve the general physical condition of the soil.

Trellising and Planting Distance.

Growers' opinions differ on the question of the most suitable distance at which the vines should be planted. On the South Coast the most favoured distance is 10 feet between rows and 16 feet between each plant, giving roughly 270 plants to the acre. These distances permit the natural vigorous expansion of the vines along the trellis, while there is sufficient room between the rows to work horse-drawn implements without damaging the trellises, even when wide spreaders are used on the horizontal type of trellis. At the same time a better coverage is obtained, leaving little, if any, land exposed to the harmful effect of the sun's direct rays.

Planting too close in the rows is of little or no advantage, for, after the first year, the foliage of the vines will become too dense, thus necessitating the cutting out of possibly half the number of vines planted. This action is necessary to keep the foliage sufficiently open to admit light and allow for the free circulation of air throughout the vine, and also to permit dead fungus affected leaves to fall clear to the ground, carrying with them the spores which would otherwise infest other growing portions of the plant.

For the proper development and ripening of the fruit sunshine and air should penetrate to all aerial parts of the vine, hence the necessity, wherever possible, for running the trellises in a north-south direction. The vines will then have an even distribution of sunlight over the whole of the growth on the trellis.

If the vineyard is established on a steep hillside it may be inconvenient to plant north and south. However, where possible, this direction should be the rule.

If the vineyard be laid out across a slope then added provision can be made to conserve the surface soil by laying logs or stones also across the slope. The construction of contour drains to carry off excess surface water during heavy rainfall would be a decided advantage.

Plate 156.

A 10-months' old passion fruit vineyard on red-oak soil at Mudgeeraba.

The cost of wire, posts, and strainers and their erection are initial items of expenditure which influence to a great extent the choice of trellis to be erected. In commercial vineyards the trellises are mainly one of two types—either the vertical or the horizontal trellis. Both types have advantages and disadvantages, hence the main deciding factor is usually one of cost. A vertical trellis is less costly than a horizontal trellis, therefore, if posts and strainers have to be purchased growers mostly erect a vertical trellis at first; any extension of the area can be trained on a horizontal trellis if so desired when capital is available. Wherever the grower is capable of splitting and erecting the posts and strainers from suitable timber in the vicinity of the vineyard a considerable saving will be made. Usually there is plenty of suitable timber growing handy. Most of the natural hardwoods will last longer than the passion vines, which are comparatively short lived.

If selection is possible, then posts split from bloodwood, ironbark, grey gum, or yellow stringy will prove to be satisfactory in every way, for the varieties of timber named will last in the ground for many years and will serve as posts for successive sets of trellis.

The trellis should be inexpensive, although substantial enough to support a heavy growth of vines and fruit. The type of trellis erected, together with pruning and training of the vine, have an important influence in the control of fungus diseases. The idea to keep in mind should be the production of a sufficiency of surface foliage to carry a heavy crop while maintaining an open habit of growth.

The grower, therefore, may choose (1) a vertical trellis or (2) a horizontal trellis, and the height of the top wire in each case should not be less than 6 feet clear above the ground.

In a horizontal trellis the two wires are run side by side while in a vertical trellis the wires are run one above the other as in an ordinary fence. The posts for the trellis should be 7 feet 6 inches long, 7 inches wide, and not less than 4 inches thick, set 16 feet apart and 18 inches in the ground, with 10 feet between rows. The strainers should be of much heavier material, and may be either round or split. They should be set 2 feet 6 inches in the ground, and must be well strutted or stayed so as to take the strain of the wires, the portion in the ground to be free of sapwood. One strainer to every 80 yards will prove sufficient in most locations. The posts should be erected with their width across the row.

Plate 157.

Vine 10 months old. Note sturdy growth of twin leaders, dense vigorous laterals, and advanced fruit.

For a vertical trellis holes are bored in the posts, through which the wire is run. One wire is run as close to the top of the post as practicable, and the second wire is run usually between 12 and 18 inches below, 15 inches being the average spacing between these wires.

The horizontal type of trellis is mostly favoured on the South Coast, and the distance between the wires has been recently increased to 24 inches, and this apparently has a decided advantage over the closer trellis in that it permits the entry of sunlight and air between the two sets of laterals, thus promoting the flowering and setting of fruit on the inner growth of the vine. At the same time this practice should assist materially in maintaining a more open growth, allowing dead and diseased leaves to fall clear to the ground, carrying with them any fungus spores adhering to their surfaces.

In order to keep the wires apart in a horizontal trellis a T-piece not less than 2 inches by 2 inches, cut to the length desired, is fastened to to top of the post and the wires run through holes bored in the ends of the T-pieces and strained on the strainer posts.

It is an advantage to make some provision whereby the wires can be kept strained and so prevent heavily laden laterals from sagging to the ground. Small cast-iron rollers can be procured cheaply and are excellent for this purpose, being easily operated and always in position.

Plate 158.
Laterals on young vine 10 months old, showing open spacing, vigorous growth and cropping habit.

Various gauges of wire are used. Some growers prefer No. 8 galvanised iron wire, while on some of the more recently erected trellises 10 x 12 gauge high tension steel wire has been used. This wire, although rather thin, is very strong and carries the weight satisfactorily; also there is less stretching and sagging between the posts than is the case with iron wire.

Black iron wire, although cheaper to buy, should not be used in the South Coast district as it soon rusts, stretches, and sags, necessitating propping up between the posts in order to keep the laterals and fruit clear of the ground.

Should the wires sag between the posts stakes may be placed temporarily in position to support the wire until the crop has been harvested, then, after pruning, when the weight on the trellis has been reduced, the wires may be restrained with little possibility of the wire snapping.

Beginners would be well advised to experiment with a few rows of each type of trellis, and by keeping a careful check on production, &c.,

the most satisfactory type in any particular locality can be readily ascertained; any extension of area can be laid down accordingly, while original trellises can be converted as occasion requires.

Propagation.

Passion fruit plants may be propagated either from seeds or cuttings, although the latter practice is rare.

Growers are recommended to raise their own plants, and for this purpose only fruits fully matured and selected from healthy vigorous heavy-cropping vines should be used.

Growers cannot be too careful in the selection of seed material, as the passion fruit is subject to several diseases, and the possibility of transmitting these diseases by seed cannot be ignored. The seed may be allowed to dry in the pulp, provided precautions are taken to prevent the growth of moulds on the fruit. Another method is to remove the pulp, place it in a vessel of water for a few days until it ferments, when the seeds will easily separate from the fruit pulp. The seeds should then be washed in clean water and placed in the shade to dry.

Should early spring-ripened fruits be selected and the seeds planted immediately, seedlings will be ready to plant out in early summer. A later sowing would provide seedlings suitable for autumn transplanting.

If early spring planting is desired—this being the season most preferred—then seedlings should be raised from fruits maturing in the late summer. Such seedlings should be well grown before winter and be available when seasonal conditions are suitable for transplanting with every prospect of the young vines rapidly establishing themselves in their new situation. The site of the seed-bed should be very carefully selected. It should not be in close proximity to any other passion vines, either cultivated or otherwise, owing to the possibility of introducing woodiness or other diseases into the nursery. The soil should be friable and contain an abundance of plant food. After the soil has been well worked into a fine state of tilth the seeds should be planted just below the ground surface, about half an inch down, the soil afterwards being firmly pressed and covered with half an inch of fine horse manure as a mulch. The seedlings should appear in from four to six weeks, and as they develop they may be thinned out to about 4 inches apart—those remaining will then develop into sturdy plants with good root development. Lanky, weak plants will result from any crowding in the seed-bed.

Some growers first erect the trellis and then plant several seeds at the required planting distance under the trellis, afterwards selecting the most vigorous of their young plants and removing the others. This practice is not recommended as germination is often poor, the young plants are exposed to infection from any diseased vines which may be in the vineyard, and, generally, they require extra attention until they become well established.

Transplanting.

When the seedlings have attained a growth of from 6 to 9 inches they are suitable for transplanting. Larger plants have a greater tendency to wilt, and do not become established as quickly as smaller plants. Transplanting may be done at any time of the year, but from September to February is considered to be the most suitable time. Transplanting during the months from March to August is not recommended, except in very favourable locations, as the plants rarely establish themselves satisfactorily, and being more or less stunted do not respond rapidly to the following spring conditions.

Seedlings planted out between September and January should return a profitable crop in the following twelve to sixteen months, provided the seasonal conditions have been normal.

Select dull, cool, or moist weather for transplanting, as hot, sunny, or windy days injure the plants by increasing transpiration. Plant the vines under the trellis in holes which have been dug ready to receive the young plants. These holes should be large enough to allow for the natural spreading of the roots. Surface soil should be filled in around the roots and pressed down firmly. A good watering should be given each vine before the holes are filled in. If weather conditions are dry subsequent waterings and partial shading may be necessary until the plants have become well established.

Care should be taken to see that the vine is not planted deeper in the hole than it occupied in the nursery, otherwise if the crown of the plant is below the surface it may become attacked by a fungous base rot which may kill the vine.

Two or three weeks before transplanting cut back any excessive top growth the seedlings may have made, and sever the larger roots by pushing a spade down full depth along and between the rows of plants which may then be easily removed when required with a minimum of root disturbance. The seedlings will rapidly recover from the shock of transplanting. Dig only as many plants as can be transplanted within a short space of time. After removal from the nursery keep the plants covered with a piece of wet sacking to prevent the young seedlings from drying out.

About twenty-four hours before the plants are dug give the nursery bed a good watering. The roots of the young seedlings are thus less likely to be damaged by being dragged through the soil, and the plant will have absorbed also sufficient moisture to assist it to recover from the shock of transplanting.

Training the Vine.

From the beginning the grower should have a definite system in mind, and train the vine systematically, so that a good solid foundation is modelled on the trellis.

Light stakes or poles should be driven into the ground alongside the young seedlings and fastened firmly at the top to the wires on the trellis. The stakes act as supports for the vine until they have become firmly established on the wires.

Within a few weeks after transplanting the young seedlings will have become established and vigorous growth will develop.

The training of the vine should commence from the outset. With the production of vigorous growth numerous shoots will appear from the crown of the plant, also as side growths from the original stem. In most cases these latter growths are the more vigorous, and rapidly overtake the original growth of the vine. When they have attained a growth of from 12 to 18 inches in height the required number of the most vigorous growths should be selected to form the main stems of the vine. All other growth should then be carefully cut away. With the growth of the stems it is necessary to keep them tied at intervals of 9 to

12 inches to the stakes provided for that purpose, in order to prevent the young tender growth from being broken or damaged through being blown about by wind.

When tying up the stems tie first firmly to the support and then tie up young growth, leaving sufficient space for the expansion of the vine.

All side growths arising from the stems should be suppressed until the wires are reached, thus forcing all the vigour of the vine into the terminal growth.

The leaves on the main stems between the ground and the wires should be permitted to remain, as these shade the stem and assist in the natural development of the young plant. On reaching the wires, if only a single stem has been developed the terminal growth is pinched out. The vine will then put forth lateral growths from which the required number is selected to form the main leaders of the vine.

Plate 159.
Well spaced fruiting laterals on 10 months old vine.

Where two or more stems have been selected there is no necessity to stop the terminal growth, for on reaching the wires the growth is directed along the trellis and forms the main leaders. The leaders should not be permitted to ramble along the trellis at will with only the tendrils to support them, but should be kept turned over the wires and tied in position at regular intervals, care being taken to maintain the turning in the same direction, thus preventing the formation of sagging loops in the leaders.

On the leaders becoming established on the trellis cut away all unnecessary tie bands, thus preventing the cincturing of the growth as it expands. As the leaders proceed along the wires lateral growth will develop, and this will be accelerated if leader terminals are cut back on reaching the approaching growth of the neighbouring vine.

Laterals should be permitted to develop at intervals of from 9 to 12 inches, and kept hanging straight down from the leader towards the ground, thereby preventing tangling while admitting light and air, which promotes the setting of the fruit, at the same time greatly lessening the labour of harvesting, spraying, and pruning.

All laterals should be kept shortened to within 6 inches clear of the ground.

The grower should give consideration to the system of growth to be developed by the young vines, and to whether a single or multiple stem system will be more suitable.

In the single stem system one stem only is allowed to grow until it reaches the height of the wires on the trellis, when the top is pinched out and leaders are developed from the subsequent growths at the head of the vine; while in the multiple stem system two or more stems as desired are developed to form the leaders on the trellis.

The development of two main stems is most popular on the South Coast, because more growth is produced in a short period, while the vines cover the trellis rapidly. A good crop is usually set within twelve to fifteen months, provided the vines have been planted at the right time and have been given the required amount of attention.

An added advantage of the multiple leader system over the single leader is that if one stem is lost or damaged the vine does not require complete reconstruction before another crop is produced, as sufficient growth from the undamaged leader will remain on the trellis to produce a crop until an additional stem is developed to replace the lost one. All main stems should be as nearly as possible of an even size, otherwise the more vigorous stem will rob the weaker, resulting in an unbalanced growth of the vine.

Vines trained on a single main stem take longer to establish a complete cover on the trellis, but during early life are much easier to keep in control, as the growth is not nearly so dense as that developed by the multiple stem system. Under this system the terminal growth is pinched out when the stem reaches the top wire, and the required number of leaders developed from the lateral growth promoted on the main stem.

In twelve to eighteen months the vines will have become well established on the trellis, carrying sufficient growth to produce a satisfactory crop in subsequent years. On flat land or land having only a gentle slope the leaders can be trained to grow in each direction on the trellis, but on steep slopes the vines naturally grow better towards the uphill direction. The vines should be trained to assist this natural tendency.

On sloping land two main leaders trained in the uphill direction will prove satisfactory, while on gentle slopes or on flat land four main leaders may be developed and trained, one to each wire in both directions.

[TO BE CONTINUED.]

The Fruit Market.

JAS. H. GREGORY, Instructor in Fruit Packing.

THE heavy general rains experienced throughout the State have acted as a tonic on the fruit industry. Certainly fruit in season, like grapes, must suffer loss through excessive moisture causing splitting and loosening on the stems, but against this is the future development of crops now in the bud development stage.

Pineapples have lost in quality through excessive moisture. While too late to increase the coming season's crop—except, of course, where irrigation has been practised—the rain has given citrus trees a new lease of life. The rain in most cases possibly accounts for the slight easing in values experienced towards the end of March. Market values of fruit are as follows:—

TROPICAL FRUITS.

Bananas.

Brisbane.—Bunches, 2d. to 7½d. per doz. Cases—Sixes, 6s. to 12s. 9d.; sevens, 8s. to 13s. 9d.; eights, 8s. to 14s. 9d.

Melbourne.—Sixes, 17s. to 18s.; sevens, 19s. to 20s.; eights and nines, 21s. to 22s. Owing to the shortage through floods 30s. was obained at one market.

Sydney.—Sixes, 13s. to 16s.; sevens, 15s. to 17s.; eights and nines, 16s. to 20s.

It is expected that the market will ease slightly during April, but values should again be high from May onward. Attention of growers is called to the introduction of the Cluster Pack as from this month, also the new one-bushel case, which should facilitate handling. Particulars of both improvements are obtainable in a free booklet issued by the Department of Agriculture. Growers are asked to co-operate in the application of these improvements, which will make work easier and the risk of disease less.

Pineapples.

Pineapple values in Brisbane eased considerably. Prices:—

Brisbane.—Cases, 2s. to 4s. Loose, 2s. to 4s. per dozen. Roughs were approximately the same value.

Melbourne.—10s. to 14s. per case.

Sydney.—8s. to 10s. per case.

Practically all lines sent to Southern markets have been affected with water blister.

Tests have shown that the new banana bushel case, 18 inches long by 13 inches wide by 9½ inches deep, inside dimensions, is quite a good box; all sized fruit packs head and tail giving the following counts—8, 10, 12, 15, and 18. Altogether it is a very suitable case, particularly for the country order trade in which buyers want small cases.

Custard Apples.

Early consignments of this luscious fruit are now on the market. Up to 8s. for special quality fruit was obtained. Growers are warned against sending immature lines. A creamy colour in the interstices of the fruit is a good indication of maturity.

Papaws.

Prices are high for good quality fruit, 8s. to 11s. per tropical fruit case being obtained in Brisbane. Growers contemplating sending to Southern markets must exercise care in packing fruit that is not too advanced in ripeness.

Avocados.

Small consignments sent to Melbourne have realised up to 16s. per half-bushel case. Remember, this is a specialised fruit; do not spoil its future consumption development by sending to market immature fruit, which, if it does ripen, is flavourless. Present indications show that it will be a long time before the supply will overtake the demand.

Monsteras.

Melbourne.—4s. to 6s. per half-bushel case. Quite a trade is being worked up in this fruit in Melbourne.

CITRUS FRUITS.

New season grape fruit is now on the market. It is certainly remarkable the way one season's citrus production runs into another. A few early oranges have been sold at satisfactory prices. Growers must remember that a citrus acidity test is used, and oranges before going on the market should pass this test. Following are particulars of the test:—

In the case of oranges, grape fruit, and mandarins, fruit in which the weight of the hand-pressed juice is not less than 30 per centum of the total weight of the fruit, and—

(*a*) As regards navel oranges and mandarins, 10 cubic centimetres of which juice is neutralised by not more than 26 cubic centimetres of deci-normal (N/10) alkali; and

(*b*) As regards oranges (other than navel oranges and mandarins) 10 cubic centimetres of which juice is neutralised by not more than 30 cubic centimetres of deci-normal (N/10) alkali.

Lemons are still maintaining satisfactory values.

Oranges.

Prices in Brisbane for oranges:—Locals, 10s. to 12s. per bushel case; Gayndah, 12s. to 14s. per bushel case.

Sydney.—6s. to 12s.

Melbourne.—6s. to 16s.

Lemons.

Brisbane.—Gayndah, 8s. to 13s.; Benyenda, choice, 15s. to 16s.; standard, 12s. to 13s.

Sydney.—Locals, 6s. to 10s. per case; Queensland, 14s. to 17s. per case.

Melbourne.—Gayndah lemons, 14s. per case.

Grape Fruit.

Brisbane.—6s. to 8s. per bushel.

Sydney.—Queensland, 14s. to 17s. per bushel; Palestine, imported, 35s. per one and a-half bushel export case.

Melbourne.—16s. to 20s. per bushel; imported, Palestine, 45s. per export case.

Passion Fruit.

Brisbane.—7s. to 8s.; second grade, 1s. per case lower.

Sydney,—3s. to 8s.

Melbourne.—4s. to 9s. per half-bushel.

DECIDUOUS FRUITS.

Apples.

Early export prices have been of a payable nature, returning the equivalent of 6s. to 9s., f.o.r. Stanthorpe.

Local prices are not as satisfactory as they might be, but should improve as the maturity of Granny Smiths improves and the marketing of export culls lessens.

Brisbane prices for apples.—Granny Smith, 6s. to 8s. 6d.; Jonathan, 6s. to 7s.

Grapes.

Considerable waste is being experienced after the heavy rains. Generally this season the quality has been excellent. Prices:—

Brisbane.—Muscats, 4s. to 5s. 6d. per half-bushel; Waltham Cross, 3s. to 5s.; Purple Cornichon, 5s. to 6s. 6d.; Colemans, 3s. to 4s.

Stanthorpe Rock Melons.—2s. to 4s. per bushel case.

Tomatoes.

Brisbane.—Coloured, 2s. to 3s. 6d.; green, 1s. to 2s. 6d.; ripe, 1s. to 2s.

Melbourne,—2s. to 5s.

Cucumbers.

Brisbane.—2s. to 4s. per bushel case.

Sydney.—2s. to 5s. per bushel case.

Publications.

The Banana Packing booklet is now available for distribution. Copies may be obtained free on application to the Under Secretary, Department of Agriculture and Stock, Brisbane. The publication, in addition to illustrating all the packs now in use, deals with the marketing of the bushel case. A leaflet on Rock Melon packing is ready for distribution. Lettuce packing is also obtainable.

A COMMON CAUSE OF LOW-GRADE CREAM.

Careless washing of utensils is a common cause of low-quality cream. Contamination may result from:—Failing to wash up twice daily. Washing up with cold water, either once or twice a day. Leaving the separator unwashed at night. Failing to use washing soda to remove grease from utensils. Using objectionable cloths or unclean brushes for washing up. Failing to scald thoroughly all utensils, brushes, &c., after washing. Failing to wash and scald cans on their return from the factory. Washing up utensils in polluted water—rainwater is always preferable.

The Tropics and Man

The Climates of Queensland.

DOUGLAS H. K. LEE, M.Sc., M.B., B.S., D.T.M., Professor of Physiology,
University of Queensland.

No. 4.

I SPOKE last time of a technical device which allowed us to turn the three important and variable factors in climate into a single figure which meant something concrete, and which could be used to compare one climate with another in so far as it affects man. This single figure is called ''effective temperature.'' You may ask what is wrong with the present method of comparing ordinary temperatures, as given by the Weather Bureau each day. If you have been following the theory of this business, you will remember that ordinary (dry-bulb) temperatures take no account of humidity and no account of air-movement. How often have you heard people discussing the weather—

Mrs. A.: Phew! Isn't it hot to-day?

Mrs. B.: Yes! The thermometer only says 82, but it's the humidity! or another day,

Mrs. A.: It's 110 in my kitchen to-day!

Mrs. B.: It's hot alright, but I don't mind the dry heat so much; it's the humidity that gets me down.

These two ladies are apparently agreed that a dry 110 degrees is no worse, or may even be better than a wet 82 degrees. Most people, again, as far as climate is concerned would prefer to be in Cloncurry with a temperature of 90 degrees than in Townsville with a temperature of 82 degrees.

Obviously, then, any system which takes no notice of humidity is fallacious, if we are going to compare weathers or climates as they affect man.

How the Climates are Compared.

For over fifty years the Weather Bureau has been keeping records all over Australia of temperatures, humidity, rainfall, &c. At all stations observations are made at 9 a.m. At many these are repeated at 3 p.m. At some stations further readings are made at 9 p.m., while at a very few stations continuous records are made. There have accumulated vast amounts of information of a most useful character. Unfortunately, these are for the most part unpublished. The Bureau, however, very kindly supplied us with the information we wanted—the average dry-bulb and wet-bulb temperatures for each month of the year at each of eighty-four stations throughout Queensland and the Northern Territory. Using the American figures we were able to work out the average ''effective temperature'' for each month of the year at each of these stations. We then had figures for the different places which could be compared without worrying unduly about other disturbing factors. Both temperature and humidity were accounted for. We then proceeded to study the figures, and the results proved to be well worth the trouble we had expended upon them.

Results of Enquiry.

The first point which struck us upon examining these "effective temperatures" was that the figures agreed very much more closely with one's own experiences. Instead of Cloncurry having a temperature of 90 degrees and Townsville one of 82 degrees, both now had the same figure of 79 degrees. This means that both Cloncurry and Townsville during this month have the same general effect *upon the human body*, and that this effect is the same as an atmosphere saturated with water vapour at a temperature of 79 degrees. That Cloncurry and Townsville, in spite of differences in ordinary temperature, do have the same general effect upon one's comfort and efficiency in summer is, I think, a common experience.

To look at the other side, if one trusted to ordinary temperatures alone one would be tempted to say that Charleville in the south-west had the same effect in summer as Cooktown on the north-east coast, both having an average temperature of 83·5 degrees. This is quite foreign to one's experience, and when the "effective temperatures" are worked out we find that Charleville is considerably milder than Cooktown (76 degrees as against 80 degrees).

When maps are made of the hot month temperatures, the usefulness of "effective temperatures" in comparing the effects of climate upon man is very well seen. During the hot months the ordinary temperature rises as one goes west, but changes surprisingly little as one goes north. Effective temperatures, on the other hand, rise as one goes north, and change very little except for the mountainous regions as one goes west. There is no doubt that the latter changes agree very much more with one's experiences.

The second result of the enquiry, and one of more real importance to Queensland, is that we can determine in the laboratory just what effects a certain "effective temperature" will have upon a man at rest, or upon a man at work, and determine also whether his efficiency is lowered by that temperature or what strain he is likely to suffer.

Determining the Effects of Climate.

To solve a large and complicated practical problem involving living beings nearly always means investigation along two lines. In the first place the problem must be studied in its natural surroundings and as many observations made about as many features as possible. This method alone, however, usually results in a jumble of disjointed bits of knowledge, whose relation to one another can only be guessed at. If efficiency is lower in a place with a higher temperature it does not follow that the higher temperature is the cause of inefficiency. The food may be poorer, the social life may be worse, the type of people there may not be so good, and so on. If one tries to sort out all these possible causes merely by enquiry one becomes hopelessly confused.

It is here that the second method comes in—that of experiment. To continue with the example, the *same* people, eating, the *same* food, working under exactly the *same* conditions, can be tried out at different temperatures and their efficiency measured. Such an experiment will show to what extent temperature is to blame. The importance of diet and even of social conditions can likewise be investigated.

Taken alone the experimental method has its drawbacks, too. An artificially made climate is not the same as a natural one; people do not behave in the same way when put into a hot room as they do when working in a hot climate. The ideal way is run natural observations and experimental work side by side and make each check the other.

This then is the method whereby we hope to set about investigating the effects of Queensland climates upon man. Extensive and continuous observations and tests will be made upon people following different occupations and leading different lives in different parts of the State. At the same time the effect of artificial climates will be determined in the laboratory upon unacclimatised and acclimatised people doing different kind of work, eating different kinds of food, and so on. Constant comparison of one set of results with the other will go on, and fresh avenues of investigation will be followed up as suggested by the earlier enquiries.

This means a long, continuous, and exhausting programme. Without it we can but continue with our blind guessing, and blind guessing will provide us with our just deserts—failure in the face of increasing competition.

Other Climatic Factors.

I have been concentrating upon three of the climatic factors—heat, humidity, and air movement. These are universal in operation and are undoubtedly the most important. Moreover, they can be conveniently measured and a method has been devised for dealing with all three at once. But there are other factors whose presence we must not forget. They are not always in the picture and about some of them we know very little. Nevertheless, they must not be ignored. The first and most important of these interfering factors is radiation. There are a whole group of radiations, of which heat is one. The effects of these I want to mention next time, since there is an immense amount of misconception abroad about them.

* * *

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PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society and Jersey Cattle Society, production charts for which were compiled during the month of February, 1937 (273 days unless otherwise stated.)

Name of Cow.	Owner.	Milk Production.	Butter. Fat.	Sire.
		Lb.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORNS.			
	MATURE COW (OVER 5 YEARS), STANDARD 350 LB.			
Alfa Vale Model 2nd.'	W. H. Thompson, Nanango	1,5430·9	713·544	Reward of Fairfield
Princess 2nd of Trevor Hill	J. Phillips, Sunny View, Wondai	17,386·8	677·763	Prince of Braemar
Cameo of Braemar	A. H. E. Black, Kumbia	12,132·0	543·971	Victory of Balmoral
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
Kyabram Marie 2nd	A. H. E. Black, Kumbia	10,329·0	422·655	Springlands Bridadier
College Stateley 5th	Queensland Agricultural High School and College, Gatton	6,016·83	285·47	Fussy's Kitchener of Hillview
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.			
Newhaven Calm	E. O. Jeynes, Raceview	9,621·5	431·943	Fairy Bower Brilliant
College Rascal 5th	Queensland Agricultural High School and College, Gatton	7,316·51	309·978	Fussy's Kitchener of Hillview
	JERSEY.			
	JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.			
Bellgarth Pearl	D. R. Hutton, Bellgarth, Cunningham	7,829·25	433·045	Trecarne Renown II.
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
Kingsford Dell	W. E. Meirs, Rosevale	4,922·0	297·972	Oxford Saturn
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.			
Kathleen Royal Wren	J. Goostrey, Bald Knob	6,084·75	316·91	Retford Royal Atavist
Prim Lady of Hope View	H. T. C. Gibson, Kingaroy	5,421·0	282·421	
Wyreene Rosette	J. B. Keys, Gowrie Little Plain	4,933·75	257·551	Lyndhurst Majesty

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.

Grasses from Dawson Valley Identified.

J.M. (Wowan)—

(1) *Eragrostis poeoides.* A species of love grass most frequently occurring in Queensland as a weed of cultivation. We cannot say that we have seen stock take readily to it, but in the form of hay it would probably be eaten readily enough, and this seems to apply to a number of grasses.

(2) *Dichanthium* sp., a species of blue grass. All the blue grasses are generally regarded as excellent fodders. The genus Dichanthium is at present under review, and we cannot give you a specific name.

(3) *Paspalidium caespitosum,* brigalow grass.

(4) *Dactyloctenium radulans,* button grass. This is a very common grass on parts of the Downs and in the West. Like Flinders grass it is often eaten when quite dry. It produces an abundance of seed heads, and in this stage is said to be quite nutritious.

(5) *Sporobolus pallidus,* fairy grass. This is one of the grasses that come up very quickly after summer rains. We have little information about its food value, but it is generally recognised as of second-class value. However, like some other native grasses, it is a useful addition to the average native mixed pasture.

(6) *Chloris acicularis,* curly chloris or curly windmill grass. It makes good bottom feed, but does not spread by means of runners to the extent of some of the chloris grasses.

(7) *Panicum Buncei,* a native panic grass. Most of the native panic grasses are regarded as excellent grasses in the mixed native pasture.

Wild Millet. Warrego Summer Grass. Phalaris bulbosa.

T.G. (Nerang)—

(1) *Echinochloa crus-galli,* wild millet or swamp millet, an excellent grass for wet situations. It is very closely allied to such well-known cultivated fodders as Japanese millet and white panicum.

(2) *Paspalidium flavidum,* sometimes called Warrego summer grass, fairly wildly spread in Australia and favouring flooded country. In such situations it is generally regarded as an excellent fodder.

Regarding *Phalaris bulbosa,* we do not know how this came to be mentioned as a legume. It was either a slip of the pen on our part or just one of those mistakes that will occur at times. As you surmise, it is not a legume but a true grass. All the legumes have pea flowers and seed pods.

Wild Mint.

W.H. (Dalby)—

Your specimen represents *Salvia reflexa,* the wild mint, or narrow-leafed sage. This plant has received a good deal of Press publicity due to its being such a serious pest on parts of the Darling Downs. Feeding tests prove it to be poisonous to stock, but most of the trouble experienced has been with travelling stock, ordinary paddock or resting stock seeming to browse among the plant with impunity.

If you have only a small patch the best means of eradication is, of course, to pull the plants out and carefully burn. I take it the plant is a new-comer to your district, and this would be practical at the present time and the most certain method of getting rid of the weed. The plant you forwarded did not bear many seeds, but as the seeds ripen very quickly, eradication should be carried out as soon as possible.

Barrier Salt Bush.

F.W.M. (Ducklo)—

The specimen represents *Enchylaena tomentosa,* the Barrier salt bush, a plant of the salt bush family, Chenopodiaceae. It is very common in cleared brigalow and belah country in Queensland. It is not known to possess any poisonous or harmful properties, but as far as we have observed stock do not seem to eat it, at least to any extent. We cannot say we have seen it become a serious pest on the Brigalow country.

"Coffee Bush" or Arsenic Bush.

H.C. (Mackay)—

The plant is *Cassia occidentalis,* a very common weed in North Queensland, sometimes known as "coffee senna" and at other times as "arsenic bush." The latter name is applied to several plants of the genus Cassia in North Queensland and is rather misleading. Feeding tests have been carried out with your particular plant, yielding negative results, except that the animals experimented with showed considerable purging. This is to be expected, as species of Cassia provide the senna of commerce, and practically all the members of the genus possess purgative properties.

Prickly Poppy.

J.F.D. (Mackinlay)—

Your specimen represents *Argemone mexicana,* the prickly poppy, a very common farm weed in parts of Queensland. In the North and Central-West it seems to be confined to level flats and apparently has not spread very much, for we remember seeing a few odd specimens growing about Julia Creek a good many years ago. The plant might become a serious pest on some of the alluvial country, however, for in such places on the Downs and in the neighbourhood of Brisbane it is sometimes very abundant.

So far as we have observed, we cannot say that we have ever seen it eaten by stock, but it is reputed to be poisonous. The only cases of poisoning by it have been where it has been cut, allowed to wilt, and the subsequently softened plants fed to poddy calves.

In addition to being spiny, the plant contains an intensely bitter sap which renders it unpalatable to stock.

Grasses from Central-West Identified.

L.R.B. (Blackall)—

(1) *Chrysopogon pallidus,* a very common grass throughout the whole of the Central-West and generally regarded as quite a good fodder.

(2) *Sporobolus actinocladus,* a small grass, moderately common in many places, and makes rather good bottom feed for sheep.

(3) *Enneapogon nigricans,* blackheads. A very common grass in parts of the West, generally regarded as of only secondary value as a fodder.

(4) *Brachyachne convergens,* sometimes called star grass. It is quite a luscious-looking grass, but stock do not seem to take readily to it.

(5) *Enneapogon avenaceum,* white heads.

(6) *Paspalum dilatatum,* common paspalum. This grass is very extensively cultivated on the coastal areas, particularly after the burning of big scrub.

(7) *Digitaria divaricatissima.* This is one of the roly-poly or umbrella grasses, the seed head breaking off and rolling about.

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NOTICE TO SUBSCRIBERS.

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General Notes

Staff Changes and Appointments.

Mr. C. E. Ellis, Inspector of Stock, Killarney, has been appointed District Inspector of Stock, Department of Agriculture and Stock, and the Stock District of Warwick has been assigned to him.

Mr. E. W. B. Da Costa (Sandgate) has been appointed Assistant to Plant Physiologist, and Mr. H. M. Groszmann (Woongoolba) Assistant to Horticultural Research Officer, Department of Agriculture and Stock.

Mr. W. J. Park, Cadet (Pig Branch), has been appointed Inspector under the Diseases in Stock Acts, the Slaughtering Act, and the Dairy Produce Acts, Department of Agriculture and Stock.

Mr. A. C. P. Nurcombe, Assistant Grader (Senior), Cotton Section, Department of Agriculture and Stock, has been transferred to the Glenmore Ginnery, Rockhampton.

Mr. A. R. Nott, Government Veterinary Surgeon, Blackall, has been transferred to the Animal Health Station, Yeerongpilly.

Mr. R. Small, Fairymead, Bundaberg, has been appointed an honorary ranger under the Animals and Birds Acts.

Mr. N. A. Anderson, loader for the Committee of Direction of Fruit Marketing at Burrum, has been appointed also an inspector under the Diseases in Plants Acts.

Mr. A. V. Thorp, Moreton Mill, Nambour, has been appointed millowners' representative on the Moreton Local Sugar Cane Prices Board.

Citrus Levy Regulation.

Approval has been given to the extension of the Citrus Levy Regulation, passed in April, 1936, for a further twelve months, as from the 1st March, 1937.

The Regulation empowers the Committee of Direction of Fruit Marketing to make the levy at the following rates:—

(*a*) On all citrus sold, consigned, or delivered whether by rail, road, or boat to factories, at the rate of 5s. per ton.

(*b*) On all citrus sold, consigned, or delivered by rail to any agent, person, or firm other than a factory, at the rate of 3s. 2d. per ton, with a minimum of 2d., but no levy is collected on single case consignments.

(*c*) On all citrus sold or delivered other than by rail to any railway station to any agent or person other than a factory, at the rate of 1d. per case.

Slight amendments of the Regulation include the reduction, in paragraph (*b*), of the minimum levy to 1d. instead of 2d., and in paragraph (*c*), an alteration to the effect that the levy shall be 1d. per bushel case, or ½d. per half-bushel case, with a minimum of 1d.

Open Season for Duck and Quail.

An Order in Council issued under the Animals and Birds Acts declares the periods of close season for duck and quail throughout the State. In effect, this will mean that the open season for duck and quail in the three divisions of Queensland will be:—

(*a*) *In Southern Queensland*—
For wild duck.—From 1st April to 31st August.
For quail.—From 1st May to 30th September.

(*b*) *In Central Queensland*—
For duck and quail.—From 1st July to 30th November.

(*c*) *In North Queensland*—
For duck and quail.—From 1st June to 31st October.

Packing and Grade Standards for Cavendish Bananas.

Amendments of the Fruit and Vegetable Grading and Packing Regulations issued under the Fruit and Vegetables Acts have been approved. These describe the measurements and capacity of a one-bushel banana case, and prescribe grade standards for Cavendish bananas.

The banana case shall be 18 inches long by 13 inches wide by 9½ inches deep, and its capacity shall be not less than 2,223 cubit inches.

The grade standards provide for cased bananas being divided into two grades—"Standard" and "Large." "Standard" shall mean sound fruit from 6½ to 7½ inches in length, with a minimum circumference of 4 inches. "Large" grade shall mean sound fruit over 7½ inches in length, with a minimum girth of 4½ inches, with a variation of not more than 1½ inches in length of fruit in any one case.

Sugar Levy.

Regulations have been issued under the Primary Producers' Organisation and Marketing Acts empowering the Queensland Cane Growers' Council to make a particular levy on all growers of sugar cane at the rate of one halfpenny per ton of sugar cane harvested during the coming season, the amounts raised by the levy to be expended on matters of an economic, legal, or compensatory nature, where such matters are of vital importance to the sugar industry generally.

One hundred growers of sugar cane may, on or before the 19th April next, make a request to the Minister for a poll on the question of whether or not the levy should be made.

Quarantine Area for Sugar-cane Plants.

A Proclamation issued on the 16th May, 1936, under the Diseases in Plants Acts, declared a quarantine area in portions of the parish of Sophia, Mulgrave district, on account of the prevalence of gumming disease of sugar cane, and prohibited the removal of sugar-cane plants from this quarantine area.

During the heavy wet season of last year the gumming disease outbreak in the Mulgrave area spread considerably, and it has become necessary to increase the size of the quarantine area in consequence. A Proclamation has been issued rescinding the one abovementioned, and extending the boundaries of the quarantine area in the Mulgrave area. The removal therefrom and planting therein of certain varieties of sugar cane is prohibited.

Veterinary Surgeons Board.

Executive Council approval has been given to the issue of a Proclamation bringing "*The Veterinary Surgeons Act of* 1936" into operation as from the 11th March. This Act makes provision for the registration of veterinary surgeons for which, and other purposes of administration, the Veterinary Surgeons Board has been constituted. This Board consists of Professor H. R. Seddon, D.V.Sc., Dean of the Faculty of Veterinary Science, University of Queensland; Colonel A. H. Cory, M.R.C.V.S. (L.), Chief Inspector of Stock; Messrs. E. F. Sunners, Chairman of the Queensland Meat Industry Board; J. W. Irving, M.R.C.V.S. (L.); and G. Mackay, Veterinary Surgeons. Mr. H. S. Iliff, Deputy Registrar of Brands, Department of Agriculture and stock, has been appointed Registrar of the Veterinary Surgeons Board.

A person is entitled to be registered as a Veterinary Surgeon under the Act who—

(*a*) is a holder of a degree or diploma in veterinary surgery of a university or is a member of a college of veterinary surgeons recognised by the Governor in Council;

(*b*) has undertaken a training course at, and has passed the examination prescribed by, a training institute within the Commonwealth of Australia, and approved by the Governor in Council as affording a training in veterinary science;

(*c*) has, previous to the commencement of this Act, been for a period of at least five years engaged *bonâ fide* in the practice of veterinary surgery in Queensland.

Provision is made for applications for registration as veterinary surgeons to be submitted to the Board. Regulations have also been approved which will give effect to the provisions of the Act. An Order in Council issued under the Act declares that certain operations done in connection with animal husbandry shall not constitute the practice of veterinary surgery.

Rural Topics

Standover Cotton—A Menace to Adjacent Cotton Fields.

Many farmers in the main cotton-growing areas are planting this season the whole or part of their acreage of cotton on newly broken grassland, and intend planting the old cotton fields with Rhodes grass, as the soundness of the grassland-cotton rotation has been amply borne out during the past season. It appears likely, however, that many old cotton fields will be left either as "standover" for some months, or in some cases, until the land is prepared for wheat or winter feed.

There is ample evidence to show that standover fields, through the prolific weed growth associated with them during the spring and summer months, are breeding centres for some of the major cotton pests, such as cutworm and corn ear worm, and are, therefore, a menace to adjacent fields of growing cotton. Over a series of years there have been recorded migrations of cutworms, and during the 1934-35 and 1935-36 seasons migrations of corn ear worm, from weedy standover fields to nearby seedling cotton which have caused substantial loss of stand. The weed growth is also responsible for a big increase in corn ear worm population during January and February, and heavy loss of squares and bolls in crops adjacent to a weedy standover field has occurred even in seasons of generally moderate corn ear worm attack. It is thus imperative that the grassing of standover fields be effected as soon as practicable, to eliminate completely the danger associated with weed growth adjacent to the new cotton.

Although fair stands of Rhodes grass have occasionally been obtained by sowing the seed between the rows of old cotton stalks of the "standover" field during February and March, this practice is not recommended, as more often a thin scattered stand results, and which is insufficient to smother weed growth. The growth made by Rhodes grass planted under such conditions is also usually slow, due to the surface soil being packed hard by the summer rains. It is, therefore, recommended that all standover fields be ploughed before any spring weed growth is apparent, further cultivation being given as is necessary to destroy any weed growth occurring afterwards and to establish a fine seedbed.

The preparation of a suitable seedbed for Rhodes grass is undoubtedly advisable, particularly on the old cotton cultivations of the forest soils, as this not only assists in the establishment of the seedlings but also ensures of a good supply of nitrate-nitrogen in the upper soil to promote a quick vigorous growth of grass.

As the idea of sowing the Rhodes grass on the old cotton cultivation is to check weed growth, improve the physical condition through the development of a large population of grass roots and reduce the nitrate content of the soil, it is advisable to sow the grass at a rate sufficient to give a thick even cover. In this respect it should be appreciated that Rhodes grass usually germinates only moderately well, so a good rate of sowing should be used—preferably 8 to 10 lb. per acre. Care should also be exercised to avoid sowing too deeply—dragging a brush harrow after broadcasting the seed usually gives ample cover in a normal season.—A. Nagle, Senior Instructor in Cotton Culture.

Giant Setaria (Giant Panicum).

In the past more or less confusion has arisen in connection with the sale for sowing of so-called panicum seed—*Setaria italica*. Botanically the seed in question is not a panicum, but belongs to the genus Setaria, a common collective name for which is "foxtail millet."

At the present time, *Setaria italica* (so-called panicum) may be divided into three main types, viz.,—giant, dwarf, and an admixture of both. The so-called giant panicum offered for sale in Queensland is frequently a mixture of the giant and dwarf varieties. In order to clarify the position, it has been decided that the giant and dwarf varieties shall be respectively called giant setaria and dwarf setaria. To ensure that these products will not lose their identity so far as farmers and others are concerned, they should be referred to in catalogues and other publications as follows:—

Giant Setaria (Giant Panicum), and
Dwarf Setaria (Hungarian Millet).

It may be mentioned that the identitification of the giant or dwarf varieties is comparatively simple, and is carried out by the Seed Testing Station, Department of Agriculture and Stock, Brisbane, a period of about fourteen days being required for the purpose. It is intended at an early date to publish an illustrated article on this subject, and pamphlets will be made available to those interested.—F. B. Coleman, Pure Seeds Branch.

Dehorning Cattle.

The Royal National Association offered substantial prize money for pens of bullocks suitable for the export chilled beef trade, i.e., of approved breed, liveweight about 1,100 lb., age not to exceed four years. The number of entries was large, and the high standard reached by all exhibitors was very gratifying.

It is a great pity that all who saw the stock ''on the hoof'' did not see them ''on the hooks.''

The quiet, contented appearance of the animals shows they had been well handled, the full cods, steady, bulging eyes, and the sleek hides showed they had been well finished. Any observer would have classed them as prime killers. They were. The dressed weight, 650-700 lb., met the requirements of the English market. The conformation, covering of fat, depth, and evenness of flush left little or nothing to be desired. One animal aged twenty months dressed over 700 lb.

These animals must not be regarded as something extra special—something seen only at exhibitions. During the second quarter of the year thousands of such ''fats'' are trucked to the slaughter-houses. They leaves the homesteads in just the condition these ''Exhibition'' bullocks left, yet on slaughter many of the best carcases are so badly bruised that they must partly or wholly be condemned.

The loss is borne by every section of the trade, from the grower, whose stock are ''marked down,'' to the treatment works, where loss of time in dressing such carcases means loss of money. Wherein lies the difference?

The terms of the Royal National Association's competition included '' . . . . polled, dehorned, or tipped bullocks . . . .''

By far the greater number of fats trucked to the meatworks are Herefords or their crosses. Each animal carries a pair of bayonets in the form of horns. In old animals the spread of these horns is remarkable. Anyone with the slightest knowledge of cattle recollects that the normal position of the head is drooped, but when roused the animal throws its head quickly into a raised position. Each disturbance evokes such an action, and what happens among horned stock in the close confines of a railway carriage can easily be imagined. Struggles develop, beasts ''get down,'' hooves score the fallen animal, horning takes place, and in the general fracas hips are broken, shoulders and ribs are contused. Losses which no one can afford occur.

It is often possible for cattle owners to walk large mobs to the meatworks. With careful management, the loss from bruising is small, but the loss in condition is appreciable.

Rail transport means such a saving in time that it is the recognised method of bringing stock from distant properties to the works.

Some bruising admittedly, and quite unavoidably, occurs in handling and working cattle, in the trucking yards and from the trucks themselves—particularly when stoppages are frequent—but most of the damage is wrought by horns. The obvious thing is to dehorn.

The ideal thing would be to breed hornless types. This practice is common in other beef cattle countries, but in Queensland it is not entirely practicable.

Dehorning at the calf stage is by far the easiest and most economical method. The operation can be done when calves are yarded for branding, castrating, or for any other purpose. Efficient instruments are available for ''scooping out'' the horn bud. Chemicals for suppressing horn development are also obtainable.

Failing an early dehorning, the animals should be dehorned, partly or wholly, at the beginning of the fattening period. Breaking off the horn with the aid of a hollow lever is cruel and dangerous; sawing off the unbleached, i.e., growing, portion of the horn is simple and painless. Complete dehorning of the adult animal should only be done with suitable veterinary instruments. These are obtainable in a variety of makes. They are strong, easy to use, and obtainable in Australia. Most agents are willing to demonstrate the operation. A suitable antiseptic, such as fat and Stockholm tar, should be smeared over the exposed base. As a last resort, the animals should be dehorned immediately prior to trucking.

Any notes on the advantages of dehorning would be incomplete without some reference to the animals themselves.

Dehorning largely eliminates the domineering type of animals. Horned stock should never be run with hornless. The rule should be ''all or none,'' for even the most craven horned beast soon becomes a bully among the hornless. Hornless animals are more contented and quieter. They make more rapid gains in weight. They ''handle'' better, and settle down to new conditions quicker. Moreover, you can put more of them in a truck.—Dr. M. WHITE.

Sulphuring of Pineapple Soils.

Within the past few seasons the application of sulphur to pineapple soils has been widely practised, and its effect has been of great value in the control of pineapple ''wilt disease.'' The function of sulphur is not that of a fertilizer; its value lies in the fact that it will increase the acidity or pH of the soil. It is now generally recognised that, under certain conditions, an acid soil is required for pineapple cultivation, and this is particularly the case with regard to the sandy forest areas.

The chief reason for this is that with the increased acidity the iron in the soil becomes more readily available to the plant. The presence of iron is necessary for the functioning of the chlorophyll, which is the green colouring matter of the plant leaf.

The amount of iron in the sandy forest soils is very low, and, as usually only a small part of the iron is available to the plant, it so happens that, after being cropped for a few years, this iron is all used up. This condition may be remedied by the application of sulphur, for, with the resulting increase in acidity, a sufficient quantity of iron will again become available. The response to this treatment can be detected by observing that there is a general improvement in the colour of the plant, and the new growth will be green and vigorous, in marked contrast to the pale, lifeless appearance of the previous condition.

With the heavier types of loams, and in particular the red volcanic loams, the application of sulphur is not always necessary, due to the sufficiency of available iron naturally present in the soil. However, it is a fact that in many of these heavy soils, which contain normally ten to twenty times the amount of total iron of the sandy soils, there is only a very small amount of this available, and consequently there will be a definite response to sulphuring.

In sandy soils, the pH test may be regarded as an index of the availability of the iron, and, except in the case of some virgin areas, if the pH is much above five, the application of sulphur can be confidently recommended. The amount of sulphur varies with the soil, but generally 2½ to 3 cwt. per acre should suffice for the light-coloured very sandy types. For those which are of the nature of a sandy loam, a heavier dressing of 4 to 5 cwt. per acre is necessary. With loams, and the red volcanic soils, dressings of less than 6 to 7 cwt. per acre are of little use, and, moreover, before these heavy dressings are made, advice should be obtained as to whether they are necessary, and will warrant the expenditure.

As the period in which the effect of sulphur becomes noticeable is about one to two months in the summer and at least three to six months in winter, it is advisable to apply it as soon as possible, i.e., a month or so before planting. The land should be brought to a fine tilth, and the sulphur broadcast by hand. Powdered sulphur is on the market; it is of the required degree of fineness, and is cheaper than the very fine flowers of sulphur. If at all lumpy, it should be rubbed through a sieve before distributing, in order to ensure an intimate admixture of the sulphur particles with the soil. The best time to apply is early in the morning, or on a still day, and it is very advisable to wear some form of protecting goggles, as the fine particles of sulphur cause considerable irritation to the eyes. The sulphur is then scarified in to a depth of about 4 inches; this is preferable to turning it in deeper by ploughing.

Sulphur may be applied with benefit to plants showing iron deficiency, up to twelve months old; the response, however, is not as marked as when it is applied before planting. In this case, it should be applied to the soil fairly close to the base of the plant, and then chipped in. It must be clearly understood that the sulphur should be applied to the soil itself, and that any portion lodging in the base of the leaves will be wasted. Note that this is different from fertilizer practice, for sulphur, unlike a fertilizer mixture, must be applied directly to, and thoroughly incorporated with, the soil for any reaction to take place.

Finally, it must be pointed out that the health and growth of the young plant is all important, and therefore the great value of sulphur lies in its use as a preventive and not as a cure.—L. G. VALLANCE, Analyst.

Orchard Notes

MAY.

THE COASTAL DISTRICTS.

IN these notes for the past two months the attention of citrus-growers has been called to the extreme importance of their taking every possible care in gathering, handling, packing, and marketing, as the heavy losses that frequently occur in Southern shipments can only be prevented by so treating the fruit that it is not bruised or otherwise injured. It has been pointed out that no citrus fruit in which the skin is perfect and free from injury of any kind can become blue-mouldy, as the fungus causing the trouble cannot obtain an entry into any fruit in which the skin is intact. Growers are, therefore, again warned of the risk they run by sending blemished fruit South, and are urged to exercise the greatest care in the handling of their fruit. No sounder advice has been given in these notes than that dealing with the gathering, handling, grading, packing, and marketing, not only of citrus, but of all other classes of fruit.

It is equally as important to know how to dispose of fruit to the best advantage as it is to know how to grow it. To say the least, it is very bad business to go to the expense of planting and caring for an orchard until it becomes productive and then neglect to take the necessary care in the marketing of the resultant crop. Main crop lemons should be cut and cured now, instead of being allowed to remain on the tree to develop thick skins and coarseness. As soon as the fruit shows the first indication of changing colour or is large enough to cure down to about from 2¼ to 2½ inches in diameter, it should be picked, care being taken to handle it very gently, as the secret of successfully curing and keeping this fruit is to see that the skin is not injured in the slightest, as even very slight injuries induce decay or specking. All citrus fruits must be sweated for at least seven days before being sent to the Southern States, as this permits of the majority of blue-mould infected or fly-infested fruits being rejected. Citrus trees may be planted during this month, provided the land has been properly prepared and is in a fit state to receive them; if not, it is better to delay the planting till the land is right.

In planting, always see that the ground immediately below the base of the tree is well broken up, so that the main roots can penetrate deeply into the soil and not run on the surface. If this is done and the trees are planted so that the roots are given a downward tendency, and all roots tending to grow on or near the surface are removed, the tree will have a much better hold of the soil and, owing to the absence of purely surface roots, the land can be kept well and deeply cultivated, and be thus able to retain an adequate supply of moisture in dry periods. Do not forget to prune well back when planting, or to cut away all broken roots.

All orchards, pineapple and banana plantations should be kept clean and free from all weed growth, and the soil should be well worked so as to retain moisture.

Custard apples will be coming forward in quantity, and the greatest care should be taken to see that they are properly graded and packed for the Southern markets, only one layer of one-sized fruit being packed in the special cases provided for this fruit—cases which permit of the packing of fruit ranging from 4 to 6 in. diameter in a single layer.

Slowly acting manures—such as meatworks manure—may be applied to orchards and vineyards during the month, and lime can be applied where necessary. Land intended for planting with pineapples or bananas during the coming spring can be got ready now as, in the case of pineapples, it is a good plan to allow the land to lie fallow and sweeten for some time before planting; and, in the case of bananas, scrub fallen now gets a good chance of drying thoroughly before it is fired in spring, a good burn being thus secured.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELAND.

CLEAN up all orchards and vineyards, destroy all weeds and rubbish likely to harbour fruit pests of any kind, and keep the surface of the soil well stirred, so as to give birds and predaceous insects every chance to destroy any fruit fly pupæ which may be harbouring in the soil. If this is done, many pests that would otherwise find shelter and thus be able to live through the winter will be exposed to both natural enemies and cold.

Further, it is a good plan to clean up the land before pruning takes place, as, if delayed till the pruning has been finished, the land is apt to dry out.

Pruning can be started on such varieties as have shed their leaves towards the end of the month, as it is a good plan to get this work through as early in the season as possible, instead of putting it off until spring. Early-pruned trees develop their buds better than those pruned late in the season. These remarks refer to trees—*not vines,* as the later vines are pruned in the season the better in the Granite Belt district, as late-pruned vines stand a better chance to escape injury by late spring frosts.

All worthless, badly diseased, or worn-out trees that are no longer profitable, and which are not worth working over, should be taken out now and burnt, as they are only a menace and a harbour for pests.

Land intended for planting should be be got ready as soon as possible, as, if ploughed up roughly and allowed to remain exposed to the winter frosts, it will become sweetened and the trees planted in it will come away much better than if set out in raw land. In any case the land must be properly prepared, for once the trees are planted it is a difficult matter to get the whole of the land as well worked as is possible prior to planting.

Slowly acting manures—such as ground island phosphates or basic phosphates—may be applied to orchards and vineyards. They are not easily washed out of the soil, and will become slowly available and thus ready for use of the trees or vines during their spring growth. Lime may also be applied where necessary.

This is a good time to attend to any drains—surface, cut-off, or underground. The two former should be cleaned out, and in the case of the latter all outlets should be examined to see that they are quite clear and that there is a good getaway for the drainage water. New drains may also be put in where required.

In the warmer parts citrus fruits will be ready for marketing, and lemons ready for cutting and curing. The same advice that has been given with respect to coast-grown fruit applies equally to that grown inland, and growers will find that careful handling of the fruit will pay them well. Lemons grown inland are, as a rule, of superior quality to those grown on the coast, but are apt to become too large if left too long on the trees, so it is advisable to cut and cure them as soon as they are ready. If this is done and they are properly handled they may be kept for months, and will be equal to any that are imported.

If the weather is very dry, citrus trees may require an irrigation, but, unless the trees are showing signs of distress, it is better to depend on the cultivation of the soil to retain the necessary moisture, as the application of water now is apt to cause the fruit to become soft and puffy, so that it will not keep or carry well.

Land intended for new orchards should be got ready at once, as it is advisable to plant fairly early in the season in order that the trees may become established before the weather again becomes hot and dry. If the ground is dry at the time of planting, set the trees in the usual manner and cover the roots with a little soil; then give them a good soaking; and, when the water has soaked into the soil, fill the hole with dry soil. This is much better than surface watering.

◆

POINTS IN TOMATO CULTURE.

For the best results with tomatoes it is important that only seedlings that are strong and vigorous should be planted out. Careful experiments have demonstrated the marked influence of the early life of the plant on its subsequent behaviour. In view of this, and of the fact that most plant diseases are due to parasatic fungi, the following rules should be observed:—

Choose healthy seedlings. Practise crop rotation. Raise seedlings under a waterproof cover open to the north-east. Avoid over-watering of seedlings. Spray with Bordeaux mixture. Burn the crop residue at the end of the season. Plants grown on stakes and pruned are less liable to damage by diseases and pests.

Farm Notes

MAY.

FIELD.—May is usually a busy month with the farmer—more particularly the wheatgrower, with whom the final preparation of his land prior to sowing is the one important operation. Late-maturing varieties should be in the ground by the middle of the month at the latest.

Clover land, intended primarily for feeding off, should be sown not later than the end of April.

Seed wheat should be treated with copper carbonate for the control of bunt. For oats and barley seed the use of formalin or a reliable mercury dust is advisable.

Potatoes, which in many districts are still somewhat backward, should have by this time received their final cultivation and hilling-up.

The sowing of prairie grass on scrub areas may be continued, but should be finished this month. This is an excellent winter grass, and does well in many parts of Southern Queensland. Prairie grass seed should be treated with formalin or a reliable mercury dust before sowing.

Root crops, sowings of which were made during April, should now receive special attention in the matter of thinning out and keeping the soil surface well tilled to prevent undue evaporation of moisture.

Every effort should be made to secure sufficient supplies of fodder for stock during the winter, conserved either in the form of silage or hay.

Cotton crops are now fast approaching the final stages of harvesting. All consignments to the ginnery should be legibly branded with the owner's initials. In this matter the consignor is usually most careless, causing much delay and trouble in identifying parcels, which are frequently received minus the address labels.

A PROLIFIC SOW.

The following record of a litter of fourteen pigs from the Large White Sow, Strathmore Perfection, and sired by the Large White boar, Staghorn Bradbury 14th, owned by Mr. A. G. Stewart, Strathmore Stud Piggery, Cedar Pocket, Gympie, is considered a particularly good performance and possibly an Australian record for a litter at eight weeks old.

The litter consisted of fourteen pigs at birth and all were reared, but one pig (Tattoo No. 219) was so small at birth that it was taken from the sow when a day old and hand-reared.

The sow was fed on separated milk and meal during the suckling period, and the pigs, in addition to feeding at the trough with the sow, had access to a self-feeder containing a meal mixture in a creep away from the sow.

The birth weights and the weights at fifty-six days old were taken by officers of the Department of Agriculture and Stock. The intermediate weekly weighings were taken by Mr. Stewart.

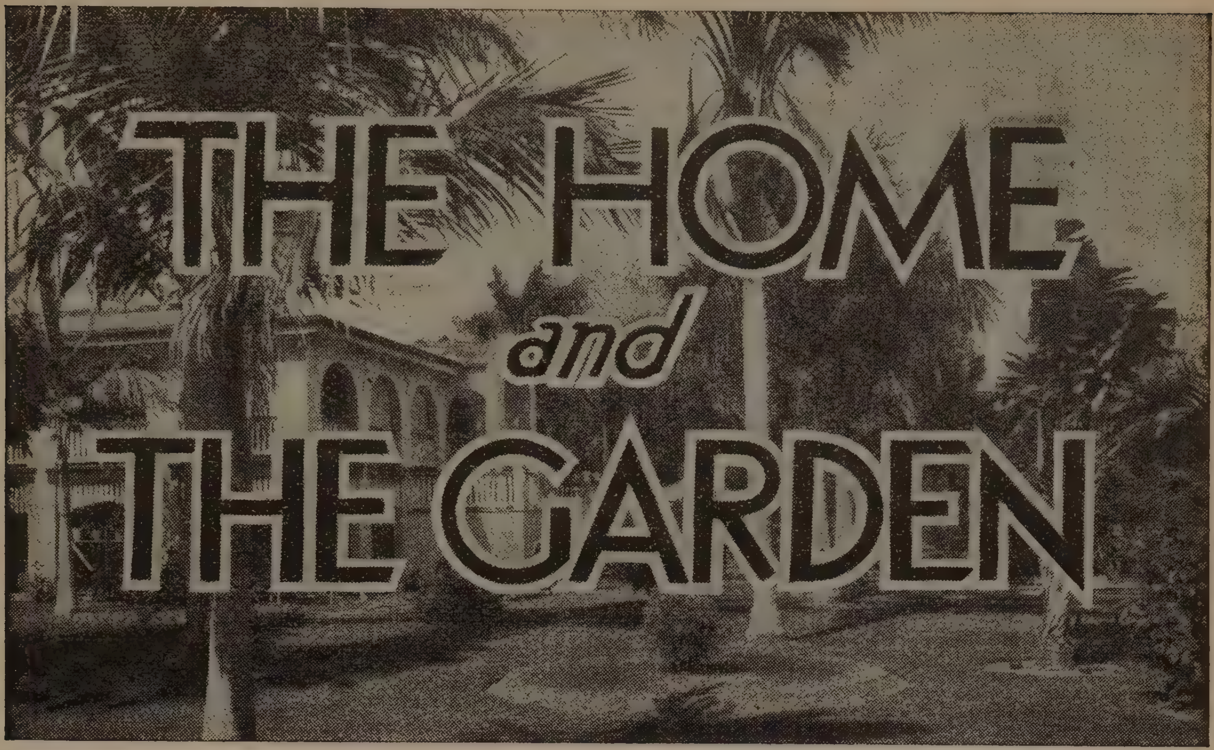
Owner: A. G. Stewart, Strathmore Stud, Cedar Pocket, Gympie.

Dam of Litter: Strathmore Perfection (Large White).

Sire of Litter: Staghorn Bradbury 14th (Large White).

Litter Born on: 11th December, 1936.

Tattoos or Earmarks.	209	210	211	212	213	214	215	216	217	218	219	220	221	222	Total.	Average.
Sexes	B	B	B	B	B	B	S	S	S	S	S	S	S	S	..	..
Weight at Birth–lb.	3	2½	3	3	2½	2½	2	3	3	3½	1½	2	3	3	37·5	2·6
Weight at 1 week	5	3½	5	5	4	4½	3	5	5	6	3	3½	5	4	61·5	4·3
Weight at 2 weeks	8	4	7½	6½	6	6	5½	8	7½	9	7	5	7	6	93·0	6·6
Weight at 3 weeks	13	7	11	9	10	10	8	11	11	13	12	7	11	10	143·0	10·2
Weight at 4 weeks	20	10	15	17	14	14	13	16	16	19	18	12	15	17	216·0	15·4
Weight at 5 weeks	26	15	22	20	19	20	18	22	22	25	25	17	27	24	302·0	21·5
Weight at 6 weeks	33	21	29	25	22	28	29	30	29	33	32	23	30	30	394·0	28·1
Weight at 7 weeks	42	26	39	33	30	32	32	36	33	41	39	29	36	35	483·0	34·5
Weight at 8 weeks	51	36	43	41	33	40	38	42	39	47	49	36	44	44	583·0	41·6



THE HOME and THE GARDEN

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

WHY IS MY CHILD NAUGHTY?

THE following talk to mothers is taken from the ''Mother and Child'' journal.

''If your child is naughty, if he is selfish, if he 'shows off,' it may not be altogether his fault. Perhaps you have made him like this. All children are naughty at times, of course, but where naughtiness has become a habit instead of an occasional lapse there is reason to suspect that all may not be well in the parents' attitude to the child, and parents who honestly desire their child's well-being and contentment will ask themselves some heart-searching questions such as these:—Are you nicer to one child than to another? Do you laugh at your child sometimes when he is naughty and sometimes when he is good? No wonder he is puzzled! How can he possibly know what to do in order to please his parents? Is your attitude consistent, that is, can your child understand your attitude to right and wrong? Do you punish the children when you are angry? The story is told of a mother who was punishing her little boy very severely, when a friend asked her whether it did the child any good to be smacked so hard. The mother answered, ''Perhaps it doesn't do him any good, but it does me lots of good.'' Children know when they are being punished unfairly, and unjust punishment will only make them more difficult than ever to manage. Do you punish your children too severely? If you do this they will tell lies to avoid being punished.

''Are you always truthful yourself, both in what you say and what you do?

''Supposing a friend telephones and asks you, for example, to go to the pictures with her, and your boy answers the telephone. Do you say to him, 'I don't want to go. Tell her I have a headache'? Can you wonder if the next morning your boy 'has a headache' when it is time for him to go to school?

''Are you letting your little child grow up and begin to be independent of you, or are you trying to keep him a baby? We cannot blame parents for being rather sad when they see their baby growing out of babyhood, but it is a very bad policy to try to hold back the child's growth, to try to force him to remain a baby by doing everything for him, and talking to him in 'baby talk.' Children want to do things for themselves, and if they are not allowed to try they very often become naughty. They love to 'help,' and though their efforts may be very clumsy at first they should be encouraged in spite of accidents. Some parents, when they see a broken cup or something spilled on the floor, scold the child and refuse to let him help. The child learns that it is safer for him not to help. Later on, when his parents want him to be useful and helpful, he will refuse, and he will be blamed for selfishness and laziness. But who taught him to be selfish and lazy?

''Do you talk about your child before him? Many parents do this. They think that the child is too young to understand, that he is not paying attention, or else they do not think at all. But very little children—even babies—do pay attention, and they do understand. They may not understand your words, perhaps, but they understand your voice and your face. They know when you are talking about them. If you allow your little child to hear you say to a friend, 'No, I can't go so early because Johnny cries if I don't sit with him until he goes to sleep,' you have taught him that he has only to cry and you will obey him. If you remark at breakfast, 'Father, can you make Johnny eat his porridge? I can't,' Johnny understands that he has only to say, 'I won't,' and you are helpless. If you allow a child to hear you say again and again, in his presence, that you cannot make him obey it is hardly a wonder if he becomes disobedient.

''Another point—when he is within hearing do you describe to your friends your little child's amusing and clever sayings and doings? That is the way to turn him into a 'show off,' wanting attention all the time. It is natural, of course, for parents to talk about their child's ways and laugh together over the funny little remarks he makes, but they should keep this pleasure until the child is out of earshot.

''Disagreement between the parents on some point of management, in the child's presence, is another frequent cause of disobedience. If mother forbids him to go out to play and father, more easy going, says, 'Oh, let him go! Why shouldn't he?' the child naturally feels that he need not obey his mother. Parents who are eager to be good parents will never let each other down in this way. If one thinks the other has made a mistake they will talk it over when the child cannot hear them.''

IN THE FARM KITCHEN.

POULTRY DISHES.

Chicken Loaf.

Take 2 cupfuls chopped cooked chicken, 1 cupful breadcrumbs, 1½ tablespoonfuls butter, ½ cupful milk, ½ cupful pea puree, 2 eggs, 1 onion, salt, pepper, paprika.

Slice and fry the onion. Place crumbs in a basin and pour over the heated milk. Rub enough cooked or tinned peas through a sieve to give you the quantity of puree required, then mix all ingredients together, and season to taste. Place in a baking dish which has been well greased. Bake in a moderate oven till firm and brown. Serve hot or cold. If cold, garnish with sliced tomato and serve with potato salad.

Chicken Mousse.

Take 1 cupful white chicken meat, 3 egg-yolks, 1 cupful whipped cream, ½ cupful heated chicken jelly, 1½ cupfuls milk, 1 dessertspoonful gelatine, lettuce-leaves, tomatoes.

Beat the egg-yolks. Add the milk. Cook mixture in the top of a double boiler until like custard. Cool and add chopped white chicken meat. Soak gelatine in the hot chicken jelly and dissolve, season custard to taste with salt, pepper, and paprika, and add chicken jelly and gelatine. Whip cream until thick, measure, then gradually fold into mixture, when beginning to set. Turn into a round mould rinsed out with cold water. When set turn out into a glass dish lined with lettuce leaves. Garnish with quarters of tomatoes.

Chicken Canapes.

Take 1 large cucumber, chicken, capers, tomatoes, mayonnaise, mustard, and cress, or parsley.

Peel cucumber. Cut into thick slices, scoop out centre with a cutter which is large enough to remove all but the rim. Place each cucumber ring on a thick slice of tomato, then fill rings with cold chopped breast of chicken, moistened with mayonnaise. Decorate each with minced capers, parsley, or mustard and cress.

Chicken Croquettes.

Take 2 cupfuls chopped cooked chicken, 1 cupful white sauce, ¼ teasponful onion juice, ½ teaspoonful salt, cayenne, 1 teaspoonful lemon juice, 1 egg, 1 teaspoonful chopped parsley, breadcrumbs.

Chop the chicken finely. Season to taste with cayenne and salt, lemon juice, onion juice, and parsley. Add white sauce, mix well together, shape into croquettes. Roll in crumbs, then in beaten egg and crumbs again. Fry in deep, smoking fat till crisp and brown.

Giblet Pie.

Take 2 sets poultry giblets, 1 small onion, 6 peppercorns, 1 egg, 1 lb. rump steak, sprig parsley, 1 lb. flaky pastry, cold water.

Prepare, clean, and wash giblets, and place them in a saucepan. Add peeled onion, six peppercorns, and a sprig of parsley. Cover with cold water. Bring to the boil. Add a pinch of salt, then skim. Cover and simmer gently for two hours. Then remove and allow to cool. Line the bottom of a buttered pie-dish with steak cut into small pieces, and dipped in seasoned flour. Cover with chopped giblets, and then another layer of seasoned steak. Add the giblet stock, and season highly. Cover pie-dish with pastry in the usual way. Decorate with pastry leaves and brush top with beaten egg. Bake in a quick oven for one and a-half hours.

Chicken Roly Poly.

Take 2 cupfuls minced chicken, 2 onions, 2 teaspoonfuls salt (scant), ½ cupful chopped fried bacon, 4 tablespoonfuls minced parsley, ½ teaspoonful pepper, 4 cupfuls sifted flour, 4 teaspoonfuls baking powder, 4 oz. butter, stock, about 1 cupful water.

Sift the flour with baking powder and one teaspoonful of the salt. Rub in the butter with the tips of fingers. Mix to a dough with the water. Turn on to a floured board. Divide into two portions. Roll each out to ¼ inch thick. Meanwhile, place chicken in a basin with the onions grated, finely-chopped parsley, diced bacon, and remainder of salt and pepper. Mix well. Moisten with stock or giblet gravy. Spread on pastry. Roll and press ends of pastry firmly together. Place on a well-greased baking-tin and bake for thirty-five minutes in a moderate oven.

Blanquette of Chicken.

Take 1 lb. cold chicken, ¼ lb. tongue, 1 pint white sauce, juice ½ lemon, 1 gill stock, salt, and pepper.

Place white stock in a saucepan. Stir in sauce and mix well. Add chopped chicken and the tongue cut into dice. Season to taste with salt and pepper, and add strained lemon juice. Place pan over the gas and stir until mixture is thoroughly hot. Turn on to a hot dish and serve at once with mashed potatoes.

Chicken Cream Moulds.

Take 1 tablespoonful gelatine, ¼ cupful cold chicken stock, ¾ cupful hot chicken stock, 1 cupful cold cooked chicken, 1 cupful thick cream, salt and pepper to taste, lettuce.

Soak the gelatine in the cold stock, then dissolve in the hot stock, well seasoned and strained. When mixture begins to thicken beat until it is frothy. Then add whipped cream and chicken cut into dice. Season with salt and pepper, and pour into individual moulds. Serve on a bed of lettuce leaves, and garnish with slices of hard-boiled egg.

Chicken Salad.

Take ½ pint diced cooked chicken, 1 tablespoonful lemon juice, ½ cupful diced celery, ½ cupful mayonnaise, chopped stuffed olives, lettuce, capers, salt and pepper.

Dice the chicken and mix with lemon juice, celery, and seasoning to taste. Toss in mayonnaise and serve in a bed of lettuce, and leave arranged on a pretty dish. Garnish with chopped stuffed olives and capers.

Timbale of Spaghetti and Chicken Livers.

Take 4 oz. spaghetti, 2 chicken livers, 2 tablespoonfuls grated cheese, 2 tomatoes, pepper, salt, margarine for frying.

Boil the spaghetti in salted water for twenty minutes. Fry the chicken livers and cut into small pieces. Fry the tomatoes until soft, and press them through a sieve. Mix all together, and add grated cheese, pepper and saft to taste. Stir the mixture thoroughly, and place in a timbale or ordinary casserole. Cook in a moderate oven from twenty-five to thirty minutes. Serve very hot.

Rissotto of Chicken.

Take 1 cupful cooked chicken (chopped), 1 onion, ¾ cupful rice, 1 quart chicken broth, 2 tablespoonfuls butter, grated cheese.

Melt the butter in a saucepan. Fry onion without browning it. Add chicken broth. Bring to boil, then wash and add rice. Cover saucepan. Simmer for about twenty-five minutes, shaking the pan occasionally to prevent rice sticking. Don't stir unless absolutely necessary. When ready the rice should have absorbed nearly all the broth, and the grains should be swollen and separate. Add chicken, stir for a moment or two, then turn on to a hot dish. Sprinkle thickly with grated cheese and serve at once.

DEFECTS IN DAIRY UTENSILS.

No farmer has to use tinware of various descriptions to the same extent as the dairyman, and an elementary knowledge of the use of the soldering iron is of particular value in his case. In fact, it might almost be considered a necessary part of a dairy farmer's training. The mending of leaks, the retinning of rust spots, the refixing of milk-can hoops, &c., are all jobs that are possible to a man determined to master a few essentials of the process.

It is the continuous neglect of the rough places in tinware that has such a serious effect on milk and cream quality, by affording lodging places for decaying milk and cream. The exposed metal is also attacked by the acid in the cream, and this is responsible for some of the flavour defects in butter. A few drops of solder will quickly rectify these tinware faults.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF FEBRUARY IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1937 AND 1936, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Feb. 1936.	No. of Years' Records.	Feb. 1937.	Feb. 1936.		Feb. 1936.	No. of Years' Records.	Feb. 1937.	Feb. 1936.
North Coast.	In.		In.	In.	*Central Highlands.*	In.		In.	In.
Atherton	10·65	36	12·17	15·18	Clermont	4·19	66	3·58	2·42
Cairns	15·95	55	4·90	29·57	Gindie	2·70	38	4·60	0·38
Cardwell	17·16	65	6·63	51·31	Springsure	3·83	68	4·33	0·93
Cooktown	13·79	61	9·24	22·61					
Herberton	7·95	51	9·64	10·43					
Ingham	16·43	45	6·32	41·74					
Innisfail	22·92	56	7·30	53·89					
Mossman Mill ..	18·38	24	20·64	29·15	*Darling Downs.*				
Townsville	11·26	66	4·70	28·70					
					Dalby	2·83	67	1·04	0·61
Central Coast.					Emu Vale	2·53	41	2·32	0·28
					Hermitage	2·42	31	..	0·56
Ayr	9·20	50	..	28·61	Jimbour	2·63	49	1·33	0·45
Bowen	8·78	56	5·76	16·67	Miles	2·69	52	3·08	1·64
Charters Towers ..	..	..	3·82	7·66	Stanthorpe	3·16	64	2·36	..
Mackay	11·72	66	15·38	8·78	Toowoomba ..	4·53	65	2·96	1·47
Proserpine	12·69	34	6·08	29·98	Warwick	3·05	72	0·89	0·91
St. Lawrence ..	7·74	66	9·55	5·30					
South Coast.									
Biggenden	4·40	38	3·17	1·59	*Maranoa.*				
Bundaberg	6·54	54	6·06	1·27					
Brisbane	6·41	85	5·25	1·27	Roma	2·89	63	3·75	1·72
Caboolture	7·79	50	6·53	1·61					
Childers	6·74	42	4·72	1·92					
Crohamhurst	12·89	44	9·37	2·09					
Esk	5·48	50	2·15	2·05					
Gayndah	4·24	66	1·77	0·87					
Gympie	6·80	67	6·49	2·00	*State Farms, &c.*				
Kilkivan	4·93	58	4·09	1·67					
Maryborough ..	6·81	66	6·59	2·46	Bungeworgorai ..	..	..	..	2·99
Nambour	9·74	41	7·82	3·30	Gatton College ..	3·56	38	..	2·03
Nanango	4·09	55	1·72	1·64	Kairi	9·99	21	..	18·84
Rockhampton ..	7·71	56	10·63	4·69					
Woodford	8·45	50	7·48	0·85	Mackay Sugar Experiment Station	10·91	40	22·77	27·21

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—FEBRUARY, 1937.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Means at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.					
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·77	90	75	95	13, 17, 18, 19	72	2, 3	924	16
Herberton	..	83	64	86	21, 22, 23	59	2, 13	964	15
Rockhampton	29·84	87	72	98	23	68	18, 19, 27	1063	12
Brisbane	29·97	84	68	92	22	63	1, 20, 27	127	15
Darling Downs.									
Dalby	29·91	87	63	98	21, 22	55	20	104	8
Stanthorpe	..	77	57	89	9	44	23	236	15
Toowoomba	..	..	60	93	21, 22	52	17	296	11
Mid-Interior.									
Georgetown	29·80	92	71	99	12	63	13	473	9
Longreach	29·80	97	71	109	2	64	12	431	8
Mitchell	29·88	86	65	98	1	55	24	453	6
Western									
Burketown	29·77	95	77	103	12	69	6	180	8
Boulia	29·77	101	75	108	1, 2, 3, 4	69	7	77	1
Thargomindah	29·81	94	72	105	1, 2	65	11, 12, 13, 23, 24	87	4

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

					MOONRISE.	
	April. 1937.		May. 1937.		April. 1937.	May. 1937.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	6·2	5·50	6.18	5·20	9·2	9.39
2	6·3	5·49	6·18	5·19	9·52	10·29
3	6·3	5·48	6·19	5·18	10·44	11·24
4	6·4	5·46	6·20	5·17	11·41	..
					a.m.	a.m.
5	6·4	5·45	6·20	5·17	..	12·22
6	6·5	5·44	6·21	5·16	12·37	1.20
7	6·5	5·43	6·21	5·15	1·35	2·20
8	6·6	5·42	6·22	5·14	2·36	3·23
9	6·6	5·41	6·23	5·14	3·38	4·31
10	6·7	5·40	6·23	5·13	4·40	5·39
11	6·7	5·39	6·24	5·12	5·49	6·50
12	6·8	5·38	6·24	5·11	6·56	7·59
13	6·8	5·37	6·25	5·11	8·6	9·3
14	6·9	5·36	6·26	5·10	9·14	10·3
15	6·9	5·35	6·26	5·10	10·19	10·47
16	6·10	5·34	6·27	5·9	11·17	11·31
					p.m.	p.m.
17	6·10	5·34	6·27	5·9	12·10	12·10
18	6·11	5·33	6·28	5·8	12·53	12·45
19	6·11	5·32	6·29	5·8	1·33	1·18
20	6·12	5·31	6·29	5·7	2·9	1·50
21	6·12	5·30	6 30	5·7	2·43	2·23
22	6·13	5·29	9·31	5·6	3·16	2·58
23	6·13	5·28	6·31	5·6	3·50	3·36
24	6·14	5·26	6·32	5·5	4·21	4·14
25	6·14	5·25	6·32	5·5	4·54	4 56
26	6·15	5·24	6·33	5·4	5·34	5·44
27	6·15	5·24	6·34	5·4	6·14	6·34
28	6·16	5·23	6.34	5·3	6.59	7·27
29	6·16	5·22	6·35	5·3	7·46	8·23
30	6·17	5·21	6·35	5·2	8·38	9·19
31			6·36	5·2		10·15

Phases of the Moon, Occultations, &c.

4 Apr.	☽	Last Quarter	1 53 p.m.
11 ,,	●	New Moon	3 10 p.m.
18 ,,	☾	First Quarter	6 34 a.m.
26 ,,	○	Full Moon	1 23 a.m.

Perigee, 12th April, at 6 p.m.
Apogee, 27th April, at 8 p.m.

Mercury rises at 6.33 a.m., 31 minutes after the Sun, and sets at 6.11 p.m., 21 minutes after it on the 1st; on the 15th it rises at 7.37 a.m., 1 hour 28 minutes after the Sun, and sets at 6.27 p.m., 52 minutes after it.

Venus rises at 7.59 a.m., 1 hour 57 minutes after the Sun, and sets at 6.37 p.m., 1 hour 37 minutes after it on the 1st; on the 15th it rises at 6.35 a.m., 26 minutes before the Sun, and sets at 5.27 p.m., 8 minutes before it.

Mars rises at 8.39 p.m. and sets at 10.15 a.m. on the 1st; on the 15th it rises at 7.47 p.m. and sets at 9.25 a.m.

Jupiter rises at 12.10 a.m. and sets at 1.52 p.m. on the 1st; on the 15th it rises at 11.23 p.m. and sets at 1.3 a.m.

Saturn rises at 5.0 a.m. and sets at 5.17 p.m. on the 1st; on the 15th it rises at 4.22 a.m. and sets at 4.18 p.m.

In the months of March and April of every recurring year our evening sky is resplendent with the most brilliant of both the northern and southern constellations. When about 7 o'clock in the beginning of March Orion had reached its greatest altitude one could trace from this, the finest of all constellations, as in a great round, to the eastward, Canis Major with the wonderful Sirius, lower down Canis Minor with the deep orange-coloured Procyon, and lower still the conspicuous white stars Castor and Pollux in Gemini, and below Orion, nearest the horizon, the fine first magnitude star Capella in the great five-cornered constellation Auriga; then, upward to the north-west, the Pleiades and, nearest Orion, the Hyades—all these, though not quite so favourably placed as in February.

In April, when the enormous length of the good ship Argo with its one bright light Canopus lies westward of the Southern Cross, the whole of the Centaur, eastward of it, has arisen—of which only the Pointers were visible in March—with its great disk of beautifully grouped stars of nearly the same magnitude. And now, when Orion is nearing the horizon in the west, the Scorpion arises in the east, a rival in grace and beauty if not in brilliancy.

4th May.	☽	Last Quarter	4 36 a.m.
10th ,,	●	New Moon	11 17 p.m.
17th ,,	☾	First Quarter	4 49 p.m.
25th ,,	○	Full Moon	5 38 p.m.

Perigee, 11th May, at 4 a.m.
Apogee, 24th May, at 11 p.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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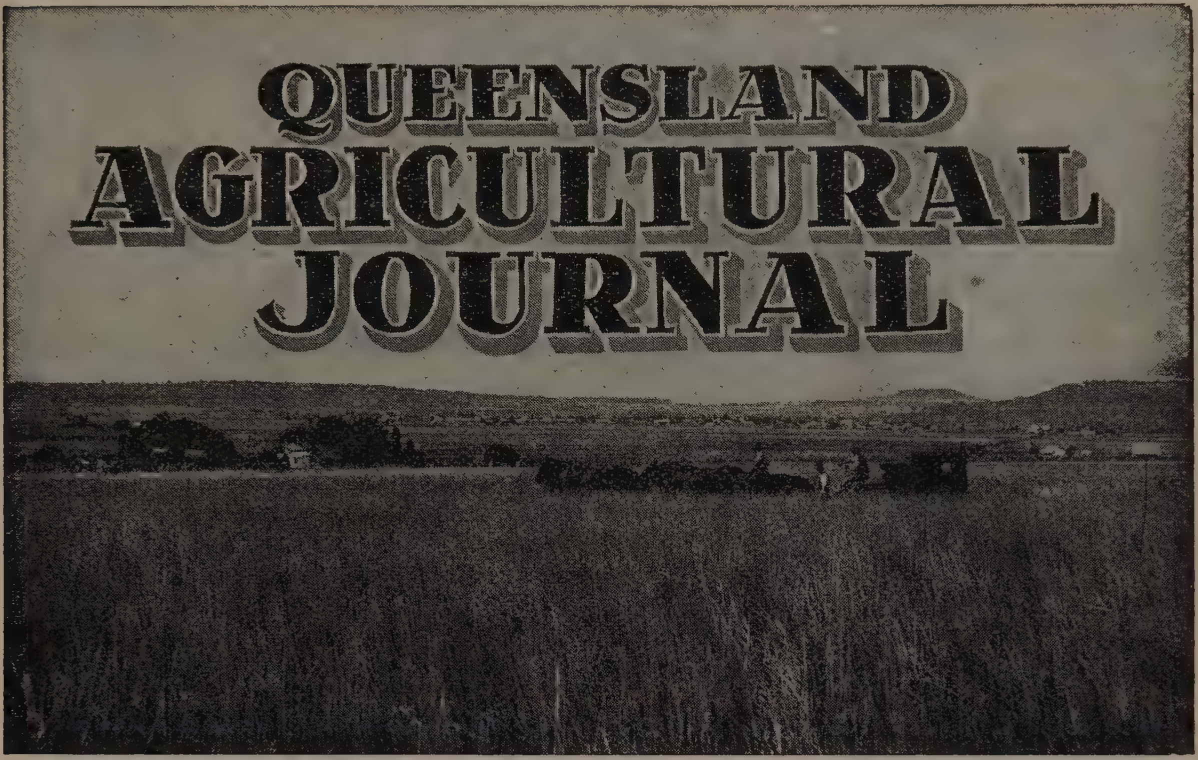


QUEENSLAND AGRICULTURAL JOURNAL

VOL. XLVIII. 1 MAY, 1937. PART 5

Event and Comment

Anzac.

THROUGHOUT the Commonwealth the Anzac Anniversary was observed with appropriate ceremony. At first regarded as an exploit, the landing on Gallipoli on Sunday, 25th April, 1915, has grown into a great and glowing tradition—a tradition shared by Australians and New Zealanders with the other forces of the Empire that took part in the hazardous adventure. How a position—an impossible position according to all the text-books of war—was held through eight long months of continuous fighting is now history. The men who made that history established a standard of courage, fortitude and devotion that inspired every Australian who fought in the later campaigns.

The spirit of Anzac, however, means something more than the mere exaltation of physical courage and other qualities that go with it. It typifies all the master virtues embodied in the highest ideals, the striving after which endows a nation with soul and character. Of the men by whose invincible valour and conquest of circumstance a standard was set and an ideal created, what more can be said? These beautiful lines of Alexander William Mair's ''In Memoriam'' give the answer:—

Though of their glory all the earth is haven,
And though their grave is under every sky,
Here lies their youth; here let their name be graven,
Who, dying, taught men how to die . . . . . .

Grave then their name, that so their name engraven
Shall be remembered to the end of days,
Who won in home or alien soil their haven—
For tomb an altar and for pity praise.

Agricultural Organisation.

"QUEENSLAND is destined to become the greatest agricultural State in the Commonwealth," said the Minister for Agriculture and Stock, Mr. Frank W. Bulcock, in the course of a recent radio address on "The March of Agriculture." To fulfil this destiny, he added, it was necessary to develop together the cultural, scientific, and economic sides of the agricultural and pastoral industries.

In its endeavour to serve the producers in each of these phases the Queensland Department of Agriculture had taken a leading part. On the cultural side the departmental officers were in intimate touch with the producers, seeking to be their counsellor and friend, giving immediate service in emergencies.

One of the present Premier's (Mr. W. Forgan Smith) finest achievements was his establishment of the Chair of Agriculture in the University of Queensland, which was a very important influence in the progress of the science and practice of agriculture in this State.

Queensland had, in some matters, commodity marketing particularly, given a lead to the world in rural economic policy, Mr. Bulcock continued. The commodity pool organisation, of which the Premier and the late Mr. W. N. Gillies were the fathers, had given the farmers control of their products from the farm to the consumer. Because of this organisation the cost of living in Queensland was lower than in any other Australian State, yet the farmers were better off as a whole than farmers anywhere else in the Commonwealth. The Commonwealth rural debts investigation disclosed that the debt per farmer was less in Queensland than in any other State. This was because the pool organisation kept the Queensland producers out of the depths of the depression.

In all branches of its work, cultural, scientific, and economic, Mr. Bulcock concluded, his department was anxious and happy to co-operate with the man on the land in dealing with the problems with which every primary producer, at one time or another, was confronted.

Subsidised Juvenile Rural Employment Scheme—An Appeal to Farmers.

TO encourage unemployed city boys to accept farm jobs in the country, it is proposed to subsidise the wages paid in certain cases. The usual wage paid to the inexperienced farm lad is 10s. a week, which is increased, as a rule, to 12s. 6d. a week at the end of six months if the lad shows satisfactory progress in farm work. It is not proposed to alter this ruling wage as paid by the farmer, but to subsidise it from Unemployment Relief Funds by such an amount as will raise the total wage to 17s. 6d. in the case of the lad 16 to 18 years of age, and to £1 per week if he is 18 to 21 years of age. This subsidy will be paid only to inexperienced or partly experienced lads (those who have not had more than six months' farming experience) of these age groups.

No subsidy will be paid in the case of the lad who has had more than twelve months' experience on a farm. It is also stipulated that a "son or relative residing with a farmer cannot be allotted to that farmer.'' The farmer will be required to pay his proportion of the wages not less frequently than fortnightly; the subsidy will be paid direct to the lad by cheque posted monthly.

For the convenience of farmers who wish to employ lads under the scheme, advantage is being taken of the State school organisation. Farmers should apply to the local school for the necessary forms.

In making the foregoing announcement, the Minister for Labour and Industry, Mr. M. P. Hynes, stated that the scheme represented a further effort on the part of the Government to encourage the unemployed youth in the city to take up farm work. According to the Council of Agriculture there is a great scarcity of juvenile labour in the country and this scarcity of juvenile farm labour has been used as an argument in favour of the resumption of assisted immigration. ''I refuse to think of that,'' said Mr. Hynes, ''as long as our own boys are unemployed. A demand for their labour exists in the country. Surely we can discover the root causes of their objection to farm work, and endeavour to remove them. That is the main purpose of this scheme. We are attempting to meet what I believe has been the main objection in the past—the low wages offered. The scheme is an experiment and its application is, therefore, limited, but we shall review it after it has been in operation for twelve months, and extend it or amend it in the light of our experience.

''I am appealing to every section of the community to help to make the scheme successful. I appeal to parents, especially to mothers, to encourage their lads, if they are unemployed, to at least give the scheme a trial. Every job will be carefully investigated before it is approved. Parents can rest assured, therefore, that their boys will go to good homes. I am appealing also to farmers. They can do much to remove the prejudice against farm work which, without a doubt, exists in the minds of city dwellers. The great majority of farmers are good employers, but there is an occasional bad employer who is a hard taskmaster, and he is responsible for this prejudice. I would ask farmers to think what the change from city to country conditions must mean to the lad who is probably leaving home for the first time. I ask them to make allowances, to be understanding, considerate, and encouraging. The city lad will, as a rule, respond to such sympathetic treatment, and will settle down to farm life and develop into a competent, capable farm worker.''

In Brisbane, boys seeking employment under the scheme should register at the Rural Section of the Juvenile Employment Bureau in the Treasury Buildings (hours 10 a.m. to 1 p.m. and 2 p.m. to 4 p.m. daily). In country centres registrations may be lodged at the local technical college or at the local State school, where the necessary forms are now available Where it is inconvenient to register locally, applications for registration may be posted direct to the Chairman, Board of Juvenile Employment, Box 1438T, G.P.O., Brisbane.

Plate 160.

THEIR MAJESTIES KING GEORGE VI. AND QUEEN ELIZABETH.

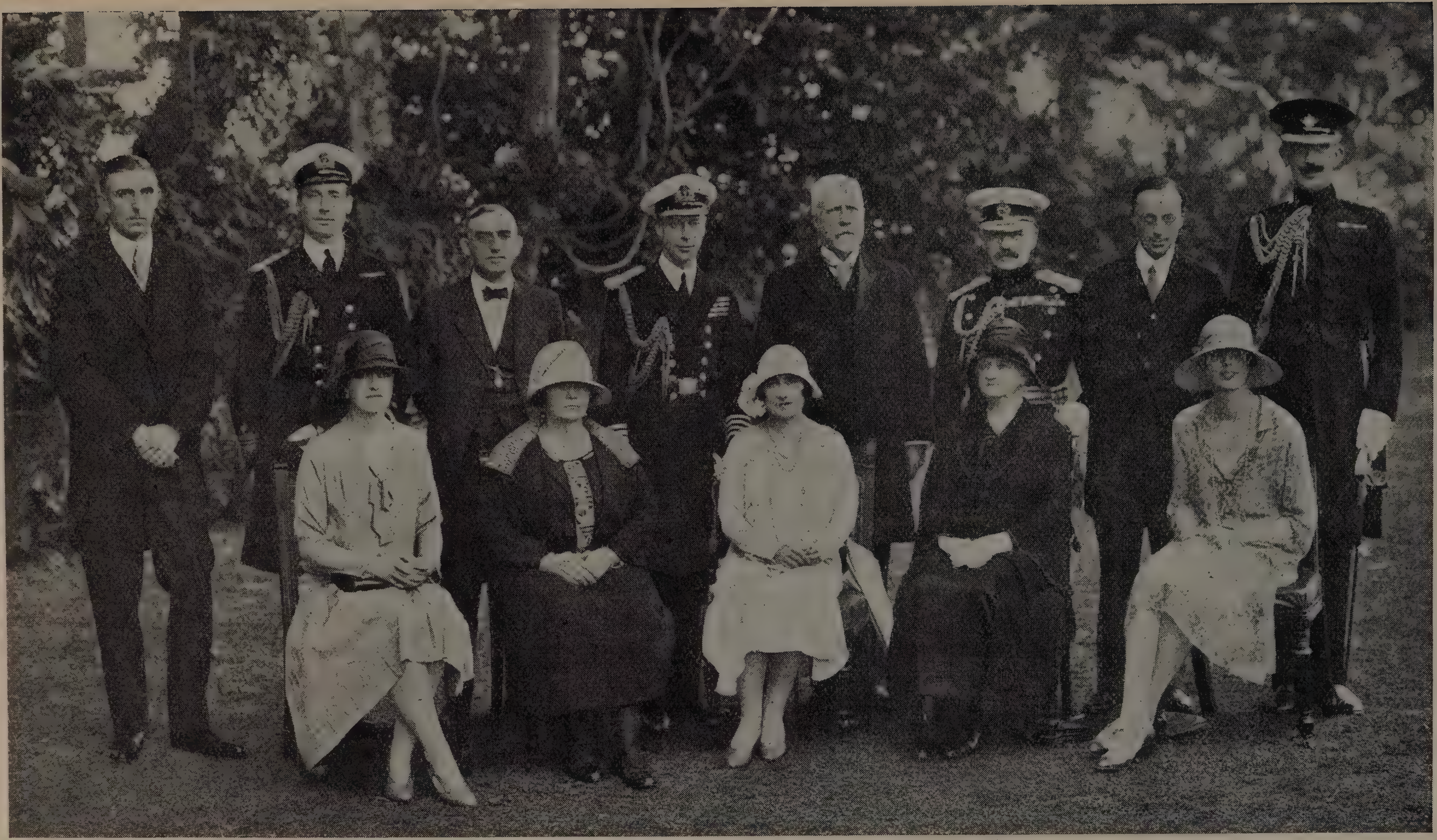


Plate 161.

THE KING AND QUEEN AT GOVERNMENT HOUSE, BRISBANE.—Group taken when Their Majesties, then Duke and Duchess of York, were visiting Queensland in April, 1927.

Seated (left to right).—The Countess of Cavan; Mrs. W. Forgan Smith; Queen Elizabeth; Mrs. W. Lennon; The Hon. Mrs. J. Little-Gilmour.

Standing (left to right).—Mr. H. F. Batterbee, C.M.G., C.V.O.; Lt. Commander Buist, R.N.; Hon. W. Forgan Smith, L.L.D., Premier of Queensland; The King; Hon. W. Lennon (then Lieutenant-Governor); General The Earl of Cavan, K.P., G.C.B., G.C.M.G., G.C.V.O.; Mr. P. K. Hodgson, C.M.G., O.B.E.; Major T. E. G. Nugent, M.C.

Plate 162.

When the King and Queen Visited Brisbane, April, 1927.—Children's Display at the Exhibition Ground.

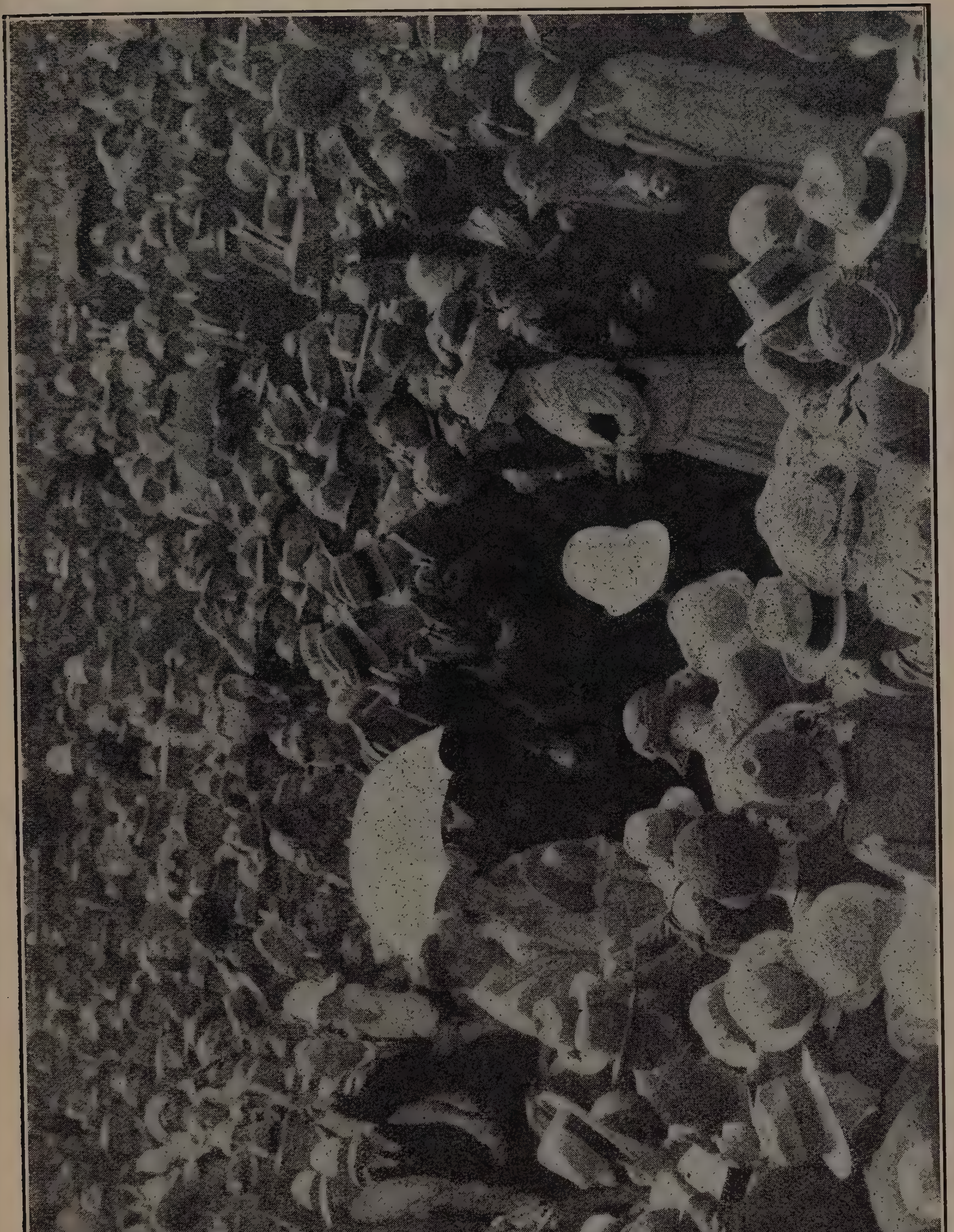


Plate 163.
Their Majesties Greeting Country People at the Beaudesert Show, 1927.

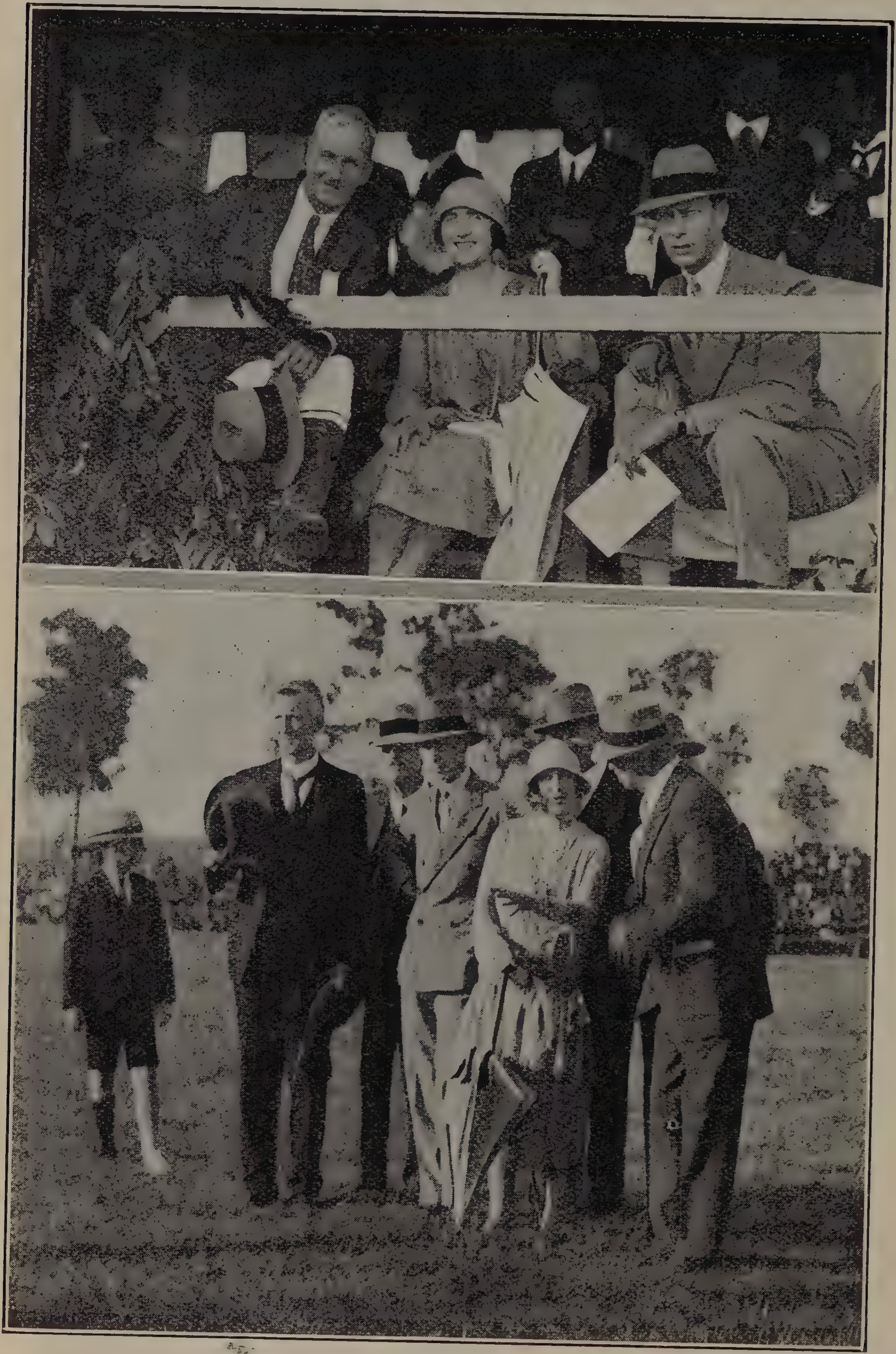


Plate 164.

IN QUEENSLAND CATTLE COUNTRY.—The King and Queen were keenly interested in the Camp Drafting at Beaudesert (9th April, 1927).

The Grasshopper Outbreak in Queensland.

1934-35.

J. A. WEDDELL, Entomologist.

[*Continued from p.* 364, *Part IV., Vol. XLVII.—April,* 1937.]

SECTION III.

CONTROL.

In the early stages of the outbreak control recommendations that would be economical and practical and would use readily available material had to be rapidly formulated. In the choice of an insecticide, the points to be decided were, firstly, whether a spray or a poison bait would be more suitable, and, secondly, which of the arsenicals would be most useful for the purpose. Experimental trials to elucidate these points were therefore carried out. The formulæ used in both the baiting and spraying trials were, of course, modelled very closely on those that are standard for the control of grasshoppers in other Australian States and in other parts of the world.

Baiting Trials.

At the moment limited quantities of several arsenicals were available, and small-scale tests were carried out. Accordingly, adjacent plots were pegged within the boundaries of a fairly large hopper swarm that was commencing to invade a wheatfield in which the plants were about 1 foot in height. Each plot included a section of grassed roadway, a strip of headland, and a portion of infested wheat. The various bait mixtures that were provisionally listed for trial were measured out in the following quantities:—

Bait No. 1—1¼ oz. white arsenic
2½ lb. bran
Bait No. 2—½ oz. sodium arsenite
2½ lb. bran
Bait No. 3—1 oz. arsenic pentoxide
2½ lb. bran
Bait No. 4—½ oz. sodium arsenite
2½ lb. wheatmeal
Bait No. 5—1 oz. arsenic pentoxide
2½ lb. wheatmeal
Bait No. 6—1 oz. arsenic pentoxide
½lb. molasses
2½ lb. bran

Wheatmeal was included in the trials, as a plentiful supply was available in the Kooroongarra area. As anticipated, the wheatmeal became a doughy mass on wetting and proved quite unsuitable for broadcast distribution. Mixtures No. 4 and 5 were therefore rejected.

Baits Nos. 1, 2, 3, and 6 were applied and adjacent areas were regarded as controls. The materials were broadcast, perforce, at 5.0 p.m. on 20th September, 1934—a rather unsuitable hour for the purpose. Almost twenty-hours elapsed before results commenced to show, but by 8.0 a.m. on 22nd September the kill on all plots was very satisfactory.

[Photo. N. A. R. Pollock.

Plate 165.

A small portion of a heavy accumulation of dead hoppers in a gutter in a road cutting, following normal baiting.

Quantitative results were not possible, but careful observations failed to show any marked difference in the toxicity of the baits. However, an examination of surplus baiting materials indicated that the mixture containing the molasses remained sticky for a longer period than the others. In later baiting work the quantity of molasses present appeared to have a marked effect on the durability of attraction of the baits, particularly in dry weather.

Larger areas were then laid down with a slightly modified bait mixture which was finally standardised by empirical methods, as follows:—

½	lb. arsenic pentoxide
4	lb. molasses
2½	gallons water
24	lb. bran

Applications of this bait were made on various types of infested country, including bare ground, pasturage, in rough gullies containing dense weeds and tufty grass, and in wheat and other crops. On bare ground and in the presence of relatively sparse feed the kill was practically 100 per cent. Where succulent feed was available, some survivors persisted, but the swarms were definitely broken up and reduced to harmless numbers. Even swarms invading young wheat having 6 inches of growth were represented only by a few living stragglers, the remainder forming a fairly dense layer of dead on the ground.

Scavenging insects, particularly the meat ant *Iridomyrmex detectus* Sm., reaped a harvest among the dead. From baited areas there were continuous streams of ants, each carrying a young dead hopper. Nests were seen that were literally covered by the garnered dead.

In a baited area very heavy accumulations of dead were generally found at the bases of posts, trees, logs, &c., within the area, beneath weeds, and among grass tufts and in small depressions. Apparently, poisoned but still surviving hoppers climbed as usual at dusk, but the lethal effects of the bait took effect during the night. The dead hoppers fell to the ground, accumulating in heaps. Similarly, poisoned hoppers that fell or were blown into cracks and holes in the ground were unable to escape. As a consequence, many of the baiting results were very spectacular. (Plate 165.)

During the course of several baiting trials at Kooroongarra it was found during the spring weather that the most satisfactory results followed the applications made between 10 a.m. and 3 p.m. The nights were cold, mornings and evenings were noticeably cool, and the hoppers did not show any marked activity until about 9 a.m.

For the swarm of average density, satisfactory results were obtained when the bait used per acre contained about 1½ bushels of dry bran. Actually, an area approximately 48 yards long and 6 yards wide was baited with 2 lb. dry weight of bran—a fairly close approximation to the average dosage. Following a good kill of hoppers on this area, some particles of bran still remained on the ground.

In practice, the best method of dealing with a particular swarm was first to determine roughly its dimensions and boundaries, making note of any guide marks such as logs or stones, or even, if necessary, inserting pegs. The broadcasting of the bait could then be carried out by traversing the area in a regular manner up and down as in sowing grain, and an adequate space beyond the swarm could also be baited. Without some such indicators or guides, it was easy, on the one hand, to miss portion of a swarm in baiting, or, on the other, to waste materials by double baiting or by working further beyond the swarm than was necessary.

With swarms of young hoppers the treatment of the area occupied and of an uninfested strip 10 feet wide beyond the swarm was sufficient, but when the hoppers were older experience showed that the extra marginal strip could be increased up to 30 feet wide with advantage.

Towards the end of the outbreak a trial was made substituting pinewood sawdust for the bran, bait being made up with each material as filler, but otherwise identical. A rather large swarm was selected for the work, one-half being treated with bran bait and the other with sawdust bait.

When the baits were applied, a few hoppers here and there were seen to nibble somewhat at the sawdust flakes. Unfortunately, heavy rain prevented observation the following day, and forty-eight hours elapsed before the plots could be examined. The sawdust bait gave results markedly inferior to those from the bran; there was a much lower kill as indicated by the dead on the ground, and there were sufficient survivors to allow a return to definite swarm formation, small bands of hoppers being scattered over the patch. The results did not warrant any further attempts to use sawdust in the bait mixture. In any case, it became obvious that any suitable materials used as a substitute for bran would need to be collected, packed, and transported to the infested districts at considerable expense.

Mass Bait Distribution.

On large holdings carrying extensive swarms, the ordinary method of distributing the bait—broadcast by hand—was rather slow. Mass baiting was successfully carried out in the following way:—The bait was mixed at a central spot and taken in a utility truck to part of the holding that meantime was being searched by one or two horsemen. The truck was then driven at moderate pace over the swarms that had been located, while two men in the back of the truck cast out the mixed bait. By using a tin plate as a scoop and making a vigorous cast, quite a large area could be effectively covered. This method needs careful supervision of the workmen, as patches of swarms here and there can easily be missed. Equally serious is the danger to stock where careless work is done, for the bait may sometimes fall in small heaps, which cattle or sheep are liable to consume.

Spraying Trials.

Coincident with the early baiting trials, some small experiments with spraying materials were carried out. The pump used was the ordinary knapsack spray pump of 4 gallons capacity. Two spray mixtures were tried, the first consisting of 4 oz. sodium arsenite in 4 gallons water, the second of 4 oz. arsenic pentoxide in 4 gallons water. Small swarms on short grass were chosen for these sprays, and an attempt was made to cover the swarms, regardless of the amounts of spray materials used. The sprays were applied at 3 p.m. on 20th September, 1934. At 8.30 a.m., 21st September, no living hoppers were found on either of the patches, the ground being thickly sprinkled with dead.

The hoppers not only ate the poisoned foliage, but also imbibed the fluid while droplets were still present on the grass a short time after spraying. It seems likely also that the soluble arsenicals would have a direct contact effect on the hoppers.

The amount of spray necessary for the work was then checked. Using a single nozzle on the spray pump, an area of approximately 8 yards by 6 yards was sprayed with 1 gallon, this being equivalent to a rate of about 100 gallons per acre. Using a double nozzle on thickly-infested headlands of a wheatfield, a strip 50 yards long by 2½ yards wide was sprayed with 4 gallons. This represented a rate of 160 gallons of spray per acre, but it must be pointed out that the area carried a fair growth of weeds and grass, and this was rather thoroughly drenched with the spray. Later, in a further measured trial, 4 gallons of fluid were spread over a circle a little over 18 yards in diameter, and a satisfactory kill of hoppers was obtained; this spraying represented a rate of approximately 75 gallons to the acre.

Modified Spraying Method.

An ingenious spraying equipment was tried in certain localities. It consisted of a small engine driving a pump, the whole outfit being mounted on the running-board of a car. The pump was linked by a hoseline to a spray tank also carried in the vehicle. A delivery hose then ran forward to a pipeline about 9 feet long clamped to the front bumper-bars of the vehicle, the pipeline being fitted with a series of nipples, each giving a flat spray directed forwards and downwards. With the pump working and the car moving, a strip about 12 feet wide was sprayed. The outfit was limited in its use to the country over which a car could travel, and it could not be directed to swarms among fallen timber or in rough country. The engine was small and low-powered, both for portability and on the score of costs, and it was found that the spray delivery did not allow of the vehicle moving more than about 4 or 5 miles per hour if a satisfactory spraying were to result.

Attempts to control swarms by merely spraying a ring of the arsenical mixture around the margin were unsuccessful. This ingenious spray arrangement in practice showed many limitations, in addition to those inherent in spraying methods generally.

Other Methods of Control.

During the grasshopper outbreak many alternative suggestions were put forward by the interested farmers and others for the control of the hoppers. These alternatives usually had little or merely temporary merit, but a brief discussion of some of them may not be out of place.

BURNING.

One burning method gave surprisingly good results so long as suitable materials were available. An old hessian bag was tied with wire to the end of a short pole and partly dampened with kerosene. After lighting, the blazing bag was then waved close to the ground as the operator moved to and fro through the swarm. The kill was excellent, and the method would be valuable early in the control operations, pending the arrival of baiting materials. The most ardent advocates of this method had no hesitation in changing to the bait method when practicable, as the burning method was unquestionably hard and very uncomfortable work. As supplies of old bags or hessian at a reasonable price are very limited, this method of control is suitable only for emergency purposes.

An alternative method—that of stringing several bags together—was tried. The string of burning bags was then dragged by two men, the bags between them, and a wide strip was thus treated at the one time. The results obtained by this modification of the burning method were very variable.

Where a hopper swarm invaded areas of dry herbage a grass fire could be very useful, but, unfortunately, the opportunities for adopting this practice were only too few.

It was not possible to test a flame-thrower at the time; so an opinion on this method of control used elsewhere cannot be given.

MILLING STOCK OVER SWARMS.

Some graziers claimed that by milling stock, particularly sheep, over a swarm of hoppers a good kill would be obtained. There is some reason to doubt the claim, as it cannot be reconciled with the following observation:—One of the egg-laying sites at Kooroongarra in May, 1934, had been located in a patch of heavy black soil near a gate used by dairy stock. When seen in September, it was hoof-pitted and obviously heavily trampled by stock. In spite of this, a hopper swarm of apparently normal dimensions emerged. Large numbers of eggs must have survived the heavy trampling of the beasts; the hoppers were, in turn, little affected.

PLOUGHING EGG-BEDS.

It has often been suggested that the emergence of hoppers can be prevented by ploughing the egg-beds. Cases were seen which gave the writer grave doubts as to the value of this method. Eggs were laid in an old cultivation paddock in May, 1934, and just before the September emergence the land was ploughed, cross-ploughed, and harrowed. Even following this treatment a hopper swarm emerged. In another area a single ploughing certainly had damaged large numbers of eggs, but sufficient survived to give rise to a dense swarm of hoppers. In any case, the ploughing of egg-beds is frequently impracticable, as they are often located in areas where implements cannot be used—for example, on land scattered with logs or stumps and on roads. A method of control involving considerable difficulties would be expected to yield better results than those in the examples cited.

Comparison in Control Methods.—Baiting v. Spraying.

At the outset there was some doubt as to the relative merits of baiting and spraying methods of control, but experience showed that the former was by far the most convenient and that there was a negligible amount of risk from the method.

The cost of the bran for large-scale baiting operations at inland centres is considerable, and the thorough mixing of the bait requires a fair amount of time. However, the preparation and application of the bait presented few difficulties. On a one-man farm the mixing could be done when temperatures were unsuitable for spreading the bait. On larger holdings where several men were employed in grasshopper destruction, some of the staff would mix and transport the bait to others who would be kept busy distributing it.

For a given area, the weight of bait required was much less than the weight of fluid needed for spraying. For example, sufficient bait for 1 acre would contain 36 lb. bran, $\frac{3}{4}$ lb. arsenic pentoxide, 6 lb. molasses, and 37½ lb. water—a total of 80 lb. approximately, while the spray required for 1 acre would weigh 815 lb., made up of 5 lb. arsenic pentoxide, 10 lb. molasses, and 800 lb. water. Transportation difficulties in spraying are thus much greater than those involved in baiting. A power pump is indispensable for spraying large areas, and the method is only economically feasible in thoroughly cleared country. Hand-spraying by means of knapsack pumps was slow and arduous compared with baiting.

The relative danger to stock of spraying and baiting control measures is of some interest. Approximately $\frac{3}{4}$ lb. arsenic pentoxide would be incorporated into the average amount of bait used per acre; in the spray 5 lb. arsenic pentoxide would be used on the same area. Portion of the bait is eaten by the hoppers, and most of the remainder settles to ground-level, out of reach of grazing stock. In contrast, most of the spray lodges on the foliage and constitutes a distinct danger until leached away by the rain.

Practical Control Difficulties.

In contral operations, locating the hopper swarms was a major difficulty. Even on the more closely settled areas hopper swarms could easily be missed, and this difficulty increased considerably in ringbarked country or open forest land. Hoppers are frequently concealed by surface litter and coarse, tufty grass. Further, if feed is scarce, they are more quickly dispersed over a wide area.

Interactions of Natural and Artificial Controls.

It has already been mentioned that Scelionid parasites were the most important agents of natural control during the outbreak. Fortunately, baiting methods of control of the hoppers could be applied anywhere at any time without affecting the Scelionid population; whereas a poison spray, burning, or comparable methods applied to young hopper swarms or over egg-beds would almost certainly kill numbers of Scelionid adults. The bait thus acted independently of the parasites, which would be quite undiminished by the artificial control and would be available for later parasitism.

Any method of hopper destruction must inevitably destroy internal Tachinid parasites. Nevertheless, while baits have no harmful effects on adult flies that may be working over the swarms, sprays or burning methods would actually destroy considerable numbers of the free-living insects.

The risk of killing insectivorous birds which might feed on poisoned hoppers was by no means ignored, but at no time during the campaign was there any observed mortality. Some domestic poultry died on one occasion when inadvertently allowed to feed over ground as it was being baited, but personal observation of the occurrence was not possible. It seems highly probable that in this instance a heavy application or an uneven scatter of the bait was made, this, indeed, being a characteristic of some of the earlier work.

The results of experiments published by F. E. Whitehead (Bulletin No. 218, Oklahoma Agricultural Experiment Station, June, 1934, "The Effect of Arsenic, as used in poisoning Grasshoppers, upon Birds") are reassuring. An abstract in the "Review of Applied Entomology," 22, pp. 687, 688, includes the following sentences: —

"In Oklahoma, domestic fowls and quail confined without food for twenty-four hours and then supplied with bran poisoned with 4 per cent. white arsenic (As_2O_3), which was scattered about the pens at the rate of 100 lb. per acre, showed no indications of poisoning after twenty-four hours. . . . . From a series of experiments in which 144 birds of various species were fed on grasshoppers, the following conclusions were drawn:—Fowls discriminate between poisoned and unpoisoned grasshoppers and eat less than half as many of the former; the amount of arsenic consumed by them in eating only poisoned grasshoppers averages less than half the toxic dose, and their weight and growth after sixty-six days is not materially affected; quails eating a normal number of grasshoppers would, if the latter were poisoned, receive only from 1 to 7 per cent. of a toxic dose of arsenic; there is practically no danger to adult wild birds from eating poisoned grasshoppers, though there might be slight danger to nestlings. Chemical analysis of the bodies of fowls that had eaten many poisoned grasshoppers showed that they could safely be used for human consumption."

The interactions between natural and artificial control measures appear to be very important, and the essential points seem worthy of emphasis:—

1. The poison bait method of control does not interfere with the operation of the egg parasites—the most valuable natural control agents.

2. Poison sprays (having contact properties), burning, and comparable methods used on young swarms inevitably kill scelionid adults.

3. To a lessened extent, this superiority of baiting over the other methods is maintained, even if other parasites are considered.

4. Insectivorous birds are not adversely affected by the correct use of the recommended control measures.

Organisation of Control Operations.

As the preliminary experimental work demonstrated that any one of the arsenicals would give satisfactory control, it was naturally decided to use the cheapest available. Arsenic pentoxide is sold to the farming community in Queensland for weed or pest destruction purposes by the Prickly-pear Land Commission at a specially reduced price of 5s. per 20-lb. tin, free on rail at the nearest railway station. Several farmers throughout the grasshopper-infested country were already in possession of some of this poison for weed destruction and tree-killing, and as further supplies could be easily obtained, arsenic pentoxide was generally recommended for baiting purposes.

During the spring generation of hoppers it was practicable for the landholders in the more affected localities to co-operate in control measures. Stocks of baiting materials were purchased by the several organisations, and these were subsidised by the Department of Agriculture and Stock by donations of equal quantities of materials. When, however, the adults from this generation developed and the local insects were supplemented by invaders from the South, it was realised that greater efforts were needed.

On 15th November, following a visit to the Goondiwindi area by the Secretary for Agriculture and Stock (Hon. F. W. Bulcock, M.L.A.), a special regulation under "*The Diseases in Plants Acts,* 1929 *to* 1930," containing the following main provisions was gazetted:—

1. The Shires of Waggamba, Inglewood, Pittsworth, and Millmerran were proclaimed quarantine areas on account of plague grasshoppers.

2. Every occupier or owner of land within the quarantine area was required to destroy larval plague grasshopper swarms by baiting or spraying in an approved manner.

3. All public bodies controlling roads, stock routes, reserves, or commons within the area were similarly required to apply control measures.

4. The ingredients used in the control measures were made available free to all interested parties. Applicants were required to declare that the materials were to be used solely for grasshopper destruction.

Central depots for the distribution of bran, molasses, and arsenic pentoxide were established in a number of centres scattered throughout and somewhat beyond the quarantine area. Public bodies assisted considerably by storing materials and issuing them to applicants. Employees were released from their normal duties to carry out baiting on lands under their jurisdiction.

Control work was taken up very enthusiastically in most localities, and numerous hopper swarms were wiped out, with a corresponding saving of much pasture. One of the motives behind the scheme of thus making bait materials available over a wide stretch of country was to provide a large scale demonstration of the value of the recommended control measures.

The official recommendations for the use of the bran bait were drafted following experience with the spring generation, but it was an allowable alternative to spray. Most of the landholders elected to bait, however, as this method of control is better suited to the varied requirements of the average holding.

The directions issued for mixing and applying both bait and spray were as follows:—

''DIRECTIONS FOR BAITING.

''BAIT FORMULA.

½ lb. Arsenic Pentoxide,
2½ gallons Water,
4 lb. Molasses,
24 lb. Bran.

''METHOD OF MIXING.

''Weigh the required quantity of poison and dissolve it in 1 pint of boiling water in one container. Mix the molasses with 1 pint of boiling water in another container. Stir each thoroughly. Divide the balance of the 2½ gallons of water—*i.e.*, 2¼ gallons—cold, between the two containers and stir. Add the molasses solution to the arsenical, and stir.

''Spread the required amount of bran on a mixing board or large sheet of iron or other impervious surface. Add the solution prepared as above and mix the whole to a moist, loose mash, making sure that no bran remains unmoistened.

''Keep the mixed bait in a loose state during transport to the field. Cover bulk supplies of bait to prevent loss of moisture.

''METHOD OF APPLYING.

''The limits of a swarm of hoppers, if not clearly defined, should be roughly determined. A strip 30 feet wide should be allowed in front of the swarm. The whole area occupied by the swarm and the strip in front should then be baited by broadcasting the poisoned bran in a finely divided state, as in the hand-sowing of grain. The bait should be thinly and uniformly applied. A quantity of bait representing 36 lb. of dry bran should be spread over 1 acre of baited ground.

"The application of the bait should be carried out in the warm part of the day, preferably between the hours of 9 a.m. and 3 p.m. A supply of bait sufficient for the day's requirements should be prepared in the early morning, so as to enable full use being made of the best hours for baiting.

"GENERAL COMMENTS.

"(1) The arsenic should not be touched, but should be manipulated with tin scoops, &c. Mixing should not be done by hand. Prior to applying the bait the hands should be coated with vaseline, petroleum jelly, or axle grease, particularly well around the nails. As soon as possible afterwards the hands should be thoroughly scrubbed.

"(2) Domestic animals, such as poultry, dogs, and so on, should not be allowed access to bulk supplies or mixing sites.

"(3) The bait should be applied fresh.

"(4) The effects of the baiting are evident after not less than twenty-four hours have elapsed.

"(5) The danger to stock roving over ground *properly baited* is negligible, owing to the small amount of poison involved and the thin distribution of the bait.

"(6) The baiting materials may be estimated sufficiently accurately as follows:—

2 2-lb. jam tins molasses = 4 lb.
2½ kerosene tins of loose dry bran = 24 lb.

"(7) It is essential that the grasshopper swarms be baited in the larval or 'hopper' stage, preferably during the first two or three weeks after emergence. Older hoppers will feed on and be killed by the bait, but, owing to the spread of the insects from the egg-beds, wider areas need to be baited. Grasshoppers in the flying stage cannot be controlled. Flying swarms should, however, be carefully watched so that egg-beds may be marked to enable the early baiting of the next generation of hoppers.

"DIRECTIONS FOR SPRAYING.

"SPRAY FORMULA.

1 lb. Arsenic Pentoxide,
2 lb. Molasses,
16 gallons Water.

"METHOD OF MIXING.

"Weigh the required quantity of poison and dissolve in 1 quart of boiling water in one container. Mix the molasses with 1 quart of boiling water in another container. Stir each thoroughly. Add these two solutions to the balance of the water required—*i.e.*, 15½ gallons water, cold, and stir.

"METHOD OF APPLYING.

"The spray should be applied by means of a spray pump with a fine nozzle. The infested area should be sprayed lightly with a fine mist so that approximately 80 gallons of spray solution are applied per acre infested with hoppers.

"GENERAL COMMENTS.

"As before, all precautions should be taken in handling and applying the poison.

"The spraying method is not officially recommended, but it is offered as an alternative to those who desire to use it. Any person using the spraying method does so at his own risk in respect to the possible danger of poisoning stock on the treated area."

As regards the best periods of the day for baiting, it was found that, for greater efficiency in the spring, baiting should not commence before about 9.0 a.m., and might continue until about 2.0 p.m. In the summer, however, it was found preferable to start earlier in the morning and to allow a break of about two hours at midday, continuing in the afternoon until about 3.0 or 4.0 p.m.

ACKNOWLEDGMENTS.

During the course of the grasshopper outbreak there were many who assisted in various aspects of the work, and thanks to all who collaborated are gratefully tendered. Particular reference may be made to Messrs. W. Dixon, Stock Inspector, Goondiwindi; W. Serisier, Shire Clerk, Goondiwindi; W. J. Tomkins, Whetstone; V. W. Gagen, Shire Clerk, Inglewood; G. Mabbet, Kooroongarra; H. McBean, Stock Inspector, Millmerran; F. C. Coleman, Stock Inspector, Pittsworth; to the members of the several local grasshopper committees at Rocky Creek, Kooroongarra, and Goondiwindi; to Mr. N. A. R. Pollock for a number of excellent photographs included amongst those illustrating this report; to Mr. I. W. Helmsing for the illustration of the life history of *C. terminifera*. Several reports by various officers of the staff have been freely used in compiling this report. Thanks are especially due to the Chief Entomologist (Mr. Robert Veitch) for his helpful interest in the work.

APPENDIX I.

A later outbreak of *Chortoicetes terminifera* was reported by Stock Inspector McBean in September, 1936. Adults first appeared as migrants in the Millmerran district about 1st September and commenced to lay immediately along the headlands of wheatfields and on roads. Mr. A. W. S. May, Assistant to Entomologist, visited the district and observed the conditions while oviposition was still in progress.

Hatching commenced on 6th October, thirty-five days after egg-laying was first observed, and hopper emergence continued for several weeks. Hopper emergence and egg-laying were both taking place on 6th October, but the insects now covered a wider area. The egg-beds were very extensive and were sufficient to initiate another large-scale outbreak. However, in common with the whole of South-eastern Queensland, the affected district was experiencing very dry weather when the hoppers emerged. In the absence of succulent herbage, the swarms of insects dispersed rapidly and most of them died within a few days.

It is interesting to note that, compared with the 1934 invasion, this outbreak showed what might be regarded as an inversion of generations. In 1934 the adults entered the district as migrants in March, oviposition occurred during April and May, and the nymphs emerged early in September. In 1936 the adults appeared in the district early in September, oviposition commenced immediately, and the nymphs emerged in October. Their behaviour on this occasion suggests that the grasshoppers had either over-wintered as adults or else climatic conditions had not been sufficiently severe to prevent development through the winter months.

APPENDIX II.

During the months of December, 1936, and January and February, 1937, the presence of *Chortoicetes terminifera* was reported from several localities, including Gatton, Toogoolawah, Thangool, near Callide, and Yarranlea.

A large swarm of hoppers was seen at Thangool, in Central Queensland, near Callide, during January. The pest had apparently bred in the heavy dark brigalow soils, but it was impossible to find the egg-beds. The swarms showed a tendency to break up when they reached the adult stage. A few fields of maize were severly damaged, but the injury was not widespread. The insects showed no tendency to invade cotton, merely defoliating a few plants along the edges of fields. Couch and Rhodes grass were preferred.

The Yarranlea report evidently referred to progeny of the survivors of the spring generation discussed in Appendix I.

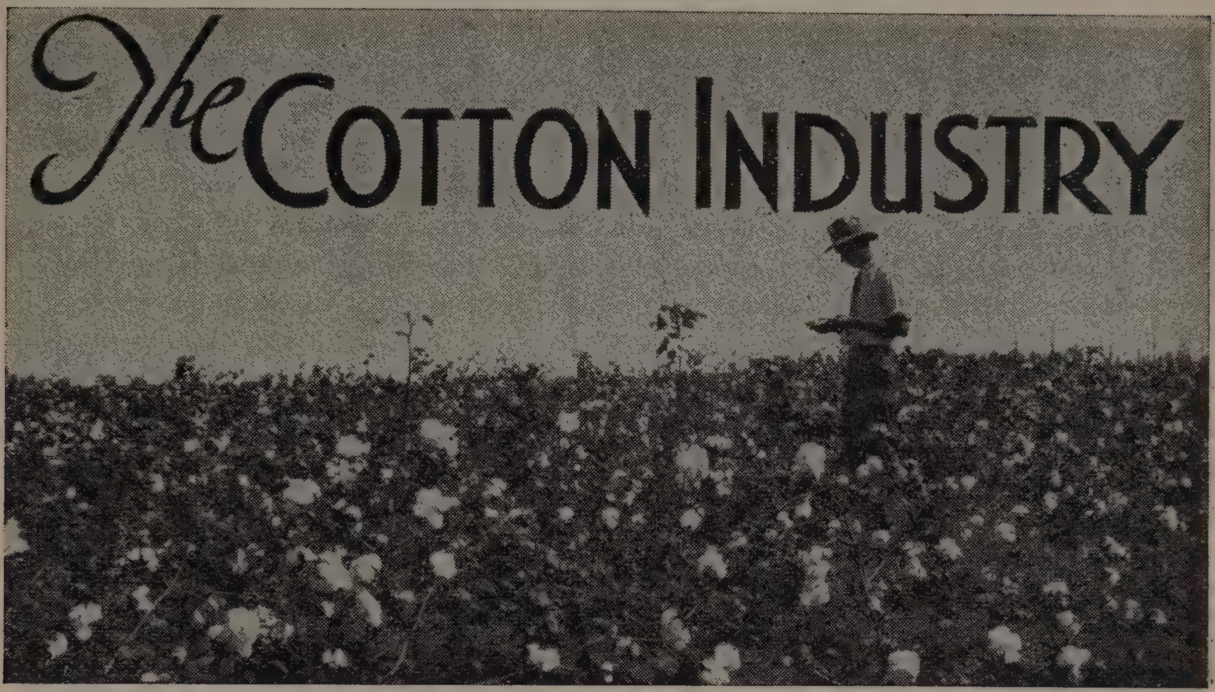
At Toogoolawah small egg-beds and hopper swarms were noticed towards the end of last year, but more recently dispersed swarms of adults have been flying in the district. Owing to the dry conditions that have prevailed in the locality for many months past, there was practically no herbage, but the adults defoliated what little there was, including small plants of the bullhead weed, *Tribulus terrestris* L., a species taken by stock in dry weather. The flying swarms fed on various crops, maize in particular, and also cotton, tomatoes, and pumpkin. The flag of the maize was stripped; quite frequently the midrib also was taken, while patches were seen in which plants up to 3 feet high were eaten down to stubble. The stalks of pumpkin vines were barked, causing in some instances the death of the younger foliage. The total loss due to grasshoppers in the district was not heavy.

Towards the end of April another generation had developed to the adult stage, and during a recent visit some rather extensive swarms of adults were seen. Small areas of certain crops such as oats, potatoes, and lucerne were damaged, but, as yet, the total losses in the Esk-Toogoolawah district were not heavy. Greater concern was felt with regard to the prospects in the spring as a number of moderately sized egg-beds were quite easily located. However, careful examination of these beds showed that they carried a large population of Scelionid egg parasites, and these parasites were found on egg-beds spread over a strip of country 20 miles long. The parasites were busily working on the surface of the ground locating egg-pods, and numbers of the latter showed signs of having been entered. The activity of these parasites suggests that they may destroy most of the eggs that have recently been laid and thus prevent a large scale emergence in the spring.

Parasites were collected and these have been kindly identified by Mr. A. P. Dodd. Of a large series of some hundred specimens collected in the Toogoolawah district, all except two specimens were *Scelio fulgidus* Crawf., the two others being *S. bipartitus* Kieff. A series collected in the Esk district was wholly *S. fulgidus*.

ERRATUM.

Since the publication of Section II. last month it has been found that the Scelionid material, referred to on p. 364, consisted of *Scelio fulgidus* Crawf., the record of *S. chortoicetes* Frogg. being introduced in error.



Harvesting Cotton.

R. W. PETERS, Cotton Experimentalist.

THE harvesting, or picking of cotton as it is commonly termed, is the most expensive single operation connected with the production of cotton. At present cotton is picked extensively by hand, which makes the harvesting a slow process.

The methods adopted in picking cotton have a decided effect on the quality of the resultant lint produced. Investigations in the United States of America have shown that the fewer cleanings cotton receives during the process of ginning the less damage will be done to the fibres. It has also been shown in England that the fewer cleaning operations the fibres are subjected to, the more suited they will be to the economical production of yarn of high quality. The harvesting of cotton, therefore, should be carefully carried out and every factor affecting the quality of the lint adversely should be guarded against.

Picking Cotton.

Picking should be commenced as soon as sufficient bolls are open to allow a moderate daily tally being obtained. An important point to observe is not to pick cotton when it is wet from either exposure or rain, or when it is green, a term used to describe fibres that have not dried out thoroughly following the opening of the boll. Not only is it difficult to clean leaf and trash from wet or damp cotton, but during ginning operations the saws cut the wet fibres very severely and tend to leave them in a twisted ropey state. Lint of this nature is easily detected and buyers penalize it heavily, for much waste is obtained from cotton during the spinning operations. In the wetter districts of the U.S.A. apparatus has been devised to dry the seed cotton before ginning, and the quality of the lint obtained from cotton treated in such manner is raised at least a whole grade. In most seasons in Queensland no difficulty should be experienced with wet cotton, for the usual climatic conditions are suitable for the harvesting of dry cotton after the dew has dried up. Where picking is done while the dew is still present the wet cotton should be spread out in the sun during the forenoon, after which it can be baled with the rest of the picking of the day.

In the earlier years of the present phase of cotton growing in Queensland, the ginneries were equipped with cleaning apparatus which was not so efficient as that now installed, and it was necessary to pick the cotton rather cleanly in order to obtain high grade lint from it. As the premiums between grades were then rather high most growers endeavoured to send clean cotton, and this tended to slow up the rate of picking. With the present more efficient machinery it is not necessary to have the cotton as nearly ‘‘snow white’’ as many growers used to send it in order to obtain the best grades. This is particularly true where the farmer and his family pick the crop, and it is suggested in such cases that it would be better to pick the cotton slightly less cleanly, and thereby faster, for not only could greater tallies be obtained in the time available for harvesting the crop, but larger acreages could be grown and still be harvested without employing labour.

Plate 166.

COTTON CROP FULLY OPENED.—Cotton in this condition should not be left for any length of time, for exposure to the elements may result in serious damage and general deterioration of the crop.

In this respect, it is pointed out that in a normal season, in cotton picked prior to the occurrence of heavy frosts, the bracts and pieces of leaf are fairly tough and pliable and do not break up into small pieces as happens after they become brittle from the effects of frosts. Early picked cotton can thus contain a fair amount of big leaf and still yield lint of high grade, for the cleaning machinery removes the big leaf without breaking it to any extent. It is a mistake, therefore, either to pick so carefully as to have little leaf, or, worse still, to roll the cotton between the hands to break up the large leaf. It is the small pieces of leaf which are difficult to remove from cotton, and seed cotton containing fine pieces of leaf or ''pepper'' leaf as it is termed have to be graded lower than cotton with big leaf. This is the reason the grades usually drop off after heavy frosts occur—the dead leaves and bracts are so brittle that they break into small pieces when picked with the cotton, and while the improved cleaning machinery eliminates much of this leaf, it is impossible to remove all; hence the necessity of grading the seed cotton lower than if the leaf was large and not brittle.

The most difficult matter to remove from the cotton lint is grass and weed seed, especially spear grass seed, and every effort should be made to clean the fields at the last cultivation so that no seed will be produced. On old cultivations even where good farming practices have been followed there is always danger of tall growing weeds setting seed late in the season, and it pays to chop out such weeds before the harvesting commences, especially if pickers are employed.

Plate 167.
Ripe for the Harvest.—A Field of Cotton, Mundubbera.

Another important point to guard against when harvesting cotton is not to leave the cotton exposed too long to the weather. Cotton, when bolls first open, has a nice richness of colour, or ''bloom'' as it is called, and it is necessary for a sample of cotton to have this ''bloom'' before it can be graded into the higher grades of the regular universal standards, although it may be free of trash. When cotton is left unpicked for several weeks the bloom is lost through the bleaching action brought about by the wetting of dews and the subsequent drying by the sun. This changes the colour to a chalky, dead white and also destroys the lustre of the fibres. The effect of storms on cotton is worse than the dews—the colour changes to a dull greyish tinge and even to a light bluish tinge when rains lasting several days are experienced. When rains do occur cotton should not be picked for several days, for the bleaching action of the dews and sun greatly improves the colour, while the wind and heat of the sun fluffs out the fibres from the matted condition caused by the rain. The grower thus benefits in two ways by delaying picking after a storm until the cotton has improved in appearance—the cotton is of more value and no payment is made for picking moisture.

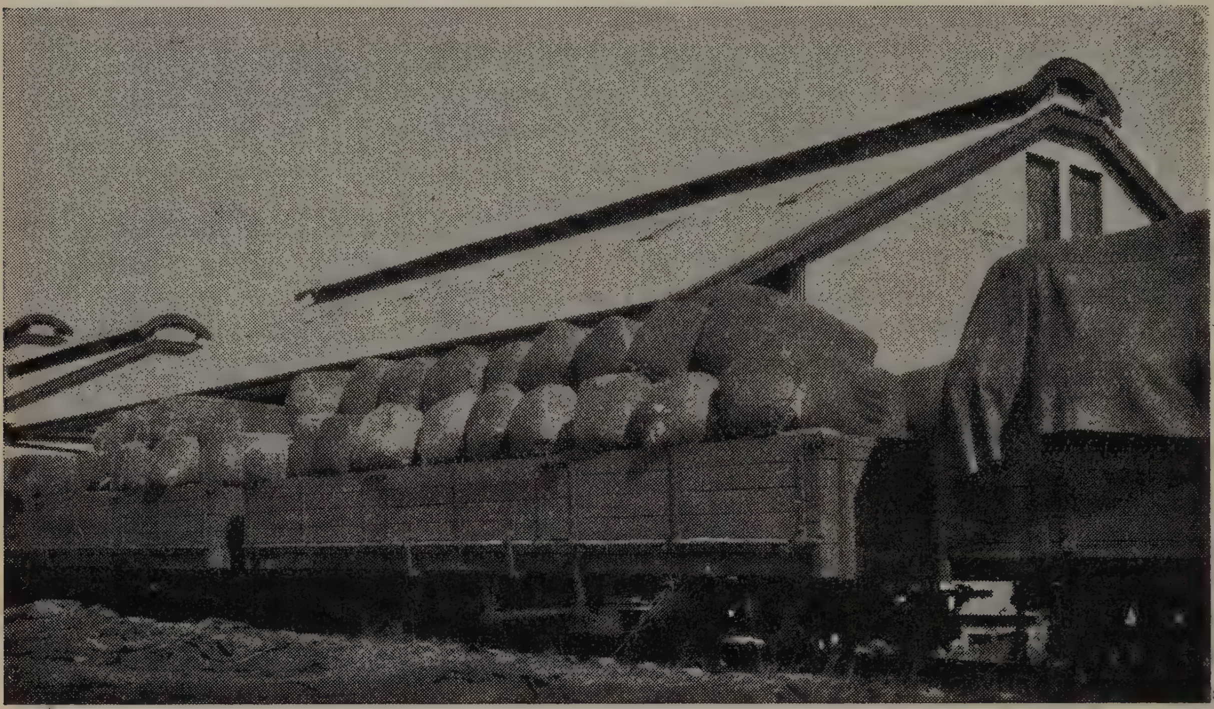


Plate 168.

QUEENSLAND COTTON ARRIVING AT THE GINNERY.—Second-hand wool packs are used for sending in the bulk of the crop. On an average 500 to 550 lb. of seed cotton is packed in each bale.

Another reason for not delaying the picking of cotton too long is the effect of winds on a well opened crop. With the continuous movement of the plants in windy weather the locks tend to hang out of the bolls in a long stringy condition. This not only allows the cotton to dry out excessively, thus losing weight and adversely affecting the character of the fibres, but also makes the cotton difficult to gin properly owing to a considerable proportion of the locks being in a twisted rope-like condition. Cotton left exposed to windy weather also usually gathers up bits of broken bracts and leaves, especially in frosted cotton. It is difficult to clean such trash in the ginneries, for the smaller pieces are generally twisted in amongst the fibres. In addition to these disadvantages much greater loss of cotton occurs during heavy storms by blowing cotton onto the ground Where the harvesting is done by the grower and his family it will pay to make several pickings in a good crop, depending on the season. Where labour is employed to harvest the crop it has to be remembered that sufficient bolls have to be open to allow the picker to make a reasonable tally, otherwise the cost of picking will be high. Generally speaking it has been found satisfactory when employing labour to make one good picking and then a clean-up in fields of light to medium yield, and two pickings and a clean-up in good crops. The grower should be guided by the conditions as they exist. Sometimes it is better to allow a heavy picking to open and thus get it picked cheaper, than to seek a higher grade by an earlier, lighter picking.

Snapping.

Cleaning machinery is now installed at the ginneries for treating "snapped" cotton. "Snapped" cotton is obtained by snapping or jerking the whole burr and contents from the plant and should be practised only after heavy frosts have been experienced. The method originated in sections of the U.S.A. during a season of labour shortage, and the cheaper harvesting costs obtained quickly brought about the general use of the system, especially in places and seasons with high picking rates. Cleaning machinery was soon evolved to remove the burrs, extra leaf and parts of the plant gathered in the snapping operations. Undoubtedly the method is of decided value in many conditions, and especially so in Queensland in harvesting the top crop. It is pointed out, however, that "snapping" should not be substituted for picking cotton that has not been well frosted. Snapping unfrosted bolls tears the plant badly and the cotton when packed in containers for forwarding to the ginnery "sweats" so badly that it is difficult to clean and gin. In addition to this, freight is paid for green wet burrs, leaves and bits of the plant instead of light dead material. Snapping mature cotton undoubtedly lowers the grade to the point where the full value of the lint cannot be obtained. On the other hand, snapping the top crop of bolls which usually contains cotton of the lower grades not only does not lower the grades materially, but enables a considerable amount of cotton being harvested cheaply which would often not have been picked. Only bolls containing marketable cotton should be snapped, however. During the past season a considerable percentage of dry, hard diseased bolls or "hickory nuts," as they have been termed, were forwarded in the late snapped cotton. As these contain no cotton and are removed in the cleaning machinery before the seed cotton is weighed, the grower pays the pickers for nothing of value, and the Cotton Board pays freight on it as well, thereby reducing the amount of the later payments. Snapping is of value to Queensland cotton growers, but should be used properly.

Packing Cotton.

Owing to the distance of the cottonfields from the ginneries in Queensland the crop is forwarded by train either in bags or wool packs containing around 80 to 100lb. and 500lb. of seed cotton respectively. The growers of small acreages generally use second-hand corn bags, etc., while those with more than 5 or 6 acres usually purchase once used wool packs for their crop. It is cheaper to use the wool packs, for each grower's individual packs are returned for a small fee and may be used again. The fee is charged to cover the cost of sterilizing the packs and the cost of return to grower.

It is pointed out that before filling a container it should be cleaned carefully to remove everything that might affect the grade of the cotton; and wool packs which have had cotton in them should be especially cleaned in order to protect the purity of the seed. Growers should pay particular attention to this feature, for undoubtedly much contamination of pure seed varieties can be brought about by the admixture caused through bits of seed cotton sticking in the corners of bales and attached to strands of the sewings along the edges, etc.

When packing a container every care should be taken to have only the one grade and staple of cotton in it. A bale of lint is sold on the basis that it contains cotton of uniform grade and staple length. If there is any variation of content encountered it is purchased on the basis of the lowest grade and the shortest staple contained. It is necessary, therefore, for the growers to assist in every way possible in obtaining uniformity of contents of the bale of lint. Very careful mixing has to be done of some wool packs received, owing to the layers of cotton of different grades pressed in them. Many large growers have the pickers empty their picking sacks directly into the wool packs, and where this is done layers of markedly different grade often result, owing to some pickers picking more trashy cotton. It is recommended that the contents of each bag should be roughly graded by the grower and an endeavour made to segregate the different grades in his cotton into separate wool packs. The grading at the ginneries could then be done more quickly, in that it would not be necessary for the grader to stop and estimate the true value of a wool pack containing different grades of seed cotton, as is now frequently done, and in addition more uniform cotton would be fed to the gins, thus enabling the production of bales of lint containing only one grade in each. This matter is of the greatest importance, and it is again emphasised that more care must be exercised by growers in seeing that the contents of any one container are even in colour and quantity of trash.

Plate 169.

UNLOADING WOOL PACKS OF SEED COTTON ON ARRIVAL AT THE GINNERY.—During the peak period of arrivals as much as 120,000 lb. of seed cotton is received in a day. Growers should therefore forward cotton in wool packs only in order to assist, as much as possible, the grading and receiving of the crop.

Forwarding Cotton.

Every grower has a registered number and should include this with his initials and railway station in a brand for identifying each container he sends. The brand should be placed in a conspicuous place on the side of the container in black that will not rub or wash off.

Each season a number of wool packs are received at the ginnery which have no identification marks, or the brands are so indistinct that they are not legible, and it is only through checking up the advice notes which a grower despatches to the Cotton Board when forwarding his cotton that the ownership can be established. This slows up the work at the ginnery and should not occur, for it is a simple matter to brand the cotton carefully.

Labelling.

It is necessary to know the variety of seed cotton in each container that arrives at the ginnery in order to determine the estimated percentage of lint contained therein. The grower is paid on the basis of the amount of lint he forwards and the grade and staple thereof, and to arrive at the lint content it is necessary to know the variety grown. Where a grower has only one variety, no label is necessary as this fact is recorded at the ginnery, but in the case of more than one variety tags for each should be used. When more than one variety is grown on a farm, great care must be exercised to prevent mixture or loss of identity of the varieties and each container should be carefully labelled with the proper tag for the variety contained in it. The label should be sown on in the usual cross diamond method which protects it from being torn off.

Careful attention to the main factors discussed in this article should result in the farmer obtaining the maximum value for this crop, and the industry as a whole will benefit by marketing lint of a higher value which the spinners will purchase with full confidence.

Plate 170.
DELIVERING DAIRY CATTLE BY AEROPLANE, NEW GUINEA GOLDFIELDS.

Agricultural Notes

COTTON.

Very favourable climatic conditions have mostly ruled throughout all districts during the past month, and good progress has been made in harvesting the earlier-sown crops. Receivals at the Glenmore Ginnery reached peak period volume at mid-month, but were of only moderate amount at Whinstanes. The general quality of the consignments to both ginneries is definitely of higher grade than usual for the first of the season. The total yield likely to be obtained is still problematical and depends on the nature of the rest of the season.

Following on the March rains, good progress is being made in the development of the top crops; also the December plantings are fruiting promisingly. Late frosts will be required, however, to ensure a good yield from the latter as a whole.

SUGAR.

Except for beneficial rains which were experienced in the far northern areas early in the month, April has been dry in all districts. Though the crop has not been severely checked as a consequence, absence of vigorous growth will be reflected in the final crop returns if these conditions persist.

At the present juncture a sugar crop of about 700,000 tons is forecast.

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Preparation of Wheat Land.

Where the initial ploughing was effected shortly after harvest and sheep have access to the fallow, weeds will not be troublesome; but elsewhere every effort should be directed to the eradication of all weed growth, thereby conserving moisture for the succeeding crop. The method of working the land after the first ploughing will depend largely on the rainfall received, but it is generally accepted that rigid time cultivators will do the best work. Spring tooth cultivators and harrows are also useful in preventing the formation of a hard crust, so that all rains in excess of 30 points should be followed with a light harrowing or cultivating.

As a firm seed-bed is required it is important to progressively reduce the depth of working as seeding time approaches. Sheep are particularly valuable in consolidating the seed-bed, besides making good use of any available weed growth. Well prepared land should be ready for sowing at the correct time, according to the variety selected, as ample subsoil moisture will bring about a satisfactory germination. On the other hand hurriedly prepared land may have to wait for additional rain to effect germination, which is a great disadvantage, as early or seasonably sown crops invariably give the best average returns.

During the 1935-36 and 1936-37 wheat seasons average yields have been considerably reduced owing to the lack of adequate rains during the growing period of the crop, resulting in some instances in complete failure. However, in every instance where early ploughing was carried out, followed by the requisite workings after all substantial rains, profitable yields were secured.

In view of the example set by farmers who regularly practise the summer fallowing of their land, it is not surprising to note the gradual improvement in cultural methods now taking place. As the heaviest rains usually occur between harvest and sowing and only one third of the average annual rainfall is received during the growing period of the wheat crop, the necessity for fallowing is self evident.

Every year progressive wheat growers are proving the value of effective cultivation, although much remains to be done, particularly in the control of weed pests such as black oats.

Economies in seed, harvesting machinery, and wages can be obtained where a bigger return is produced from a smaller well prepared area of the farm.

H. W. BALL, Assistant Experimentalist.

Onion-growing.

Although the onion is not cultivated extensively in this State, many farmers in the Lockyer Valley regularly produce satisfactory crops of high-grade bulbs which meet with a ready sale in metropolitan and, occasionally, in the interstate markets. Onions are also being successfully grown in the Brisbane Valley, Kingaroy, and Darling Downs areas, while trial plots have indicated that good-quality marketable bulbs can also be grown in the Rockhampton and Mackay districts. However, the average aggregate area under crop throughout the State rarely exceeds 500 acres, the total production from which is insufficient to meet local requirements, necessitating the annual importation of heavy supplies from the Southern States.

As sowings are usually effected during April and May, the incidence of the rainfall received during the winter months is of the utmost importance, and, when deficient, has to be supplemented by irrigation. Owing to its deep-rooting habit, the onion can withstand limited dry spells, but the best results are obtained where the growing period is fairly moist, with drier conditions towards maturity and during harvest.

Rich, well-drained, sandy loams, friable and easy to work, have proved the most suitable, producing onions of good appearance and better keeping qualities than where grown on heavier soil types. Sandy soils tend to produce bulbs of good size but low keeping quality, while heavy soils will induce thickened or bull-necked plants.

The preparation of land intended for onion cultivation will now be nearing completion, and it must be remembered that deep cultivation should be avoided as the sowing period approaches.

The seed may be broadcast in seed-beds from which the plants are transplanted to their permanent positions in the field. Alternatively, the seed may be sown in the permanent drills. The latter method is usually adopted in Queensland, utilising the ''Planet Junior'' type of hand seeder, and placing the seed in drills 12 inches to 15 inches apart, which will be found to call for 2 to 3 lb. per acre. The seed should only be lightly covered with not more than ½ inch of soil, as deeper sowings germinate very poorly.

When the young plants are 4 inches to 5 inches high they are thinned out to a distance of 4 inches to 6 inches in between plants, a practice usually carried out with the aid of a 2-inch chipping hoe.

In the southern districts sowings may be commenced late in March, continuing until May, while in the central and northern districts the period can be extended to July. If sown too early losses may result from flowering, while if too late the bulbs may be small owing to insufficient time in which to mature before the hot weather causes scalding. Sow late-maturing varieties early and early-maturing varieties late. Only freshly grown, tested seed should be utilised, as onion seed deteriorates rapidly, and it is therefore preferable to buy seed from reliable sources.

The Brown Spanish type, including ''Early Hunter River Brown Spanish,'' is the most popular, the onions being of good appearance and flavour and possessing good keeping qualities.

The hand cultivators of the ''Planet Junior'' type are useful for inter-row cultivation, as all weed growth must be kept in check. The soil should not be thrown up against the bulbs, the object being to draw the soil away rather than towards the plants, thus inducing the formation of bulbs. If the soil is not drawn away, bending over the tops with a twisting motion will assist in the formation of bulbs. When the seed-bed has been thoroughly prepared it will be found that very little hand weeding is necessary. Information on harvesting, &c., can be obtained on application to the Department of Agriculture and Stock, Brisbane.

H. W. BALL, Assistant Experimentalist.

Johnson Grass.

Johnson grass is gradually spreading in some of the agricultural areas in North Queensland, and farmers should become familiar with the plant, as it can be eradicated from small patches if dealt with efficiently. Once established over a large area no known method of eradication can be economically applied. The plant is very much like Sudan grass, and can be easily mistaken for it, but may be distinguished from this valuable fodder plant by its thick and spreading underground root stocks. Cattle have occasionally suffered from prussic acid poisoning when allowed to graze on the grass.

The roots of Johnson grass are carried from one part of the farm to another during agricultural operations and on the feet of animals. Being very thick and pithy, the rootlets may lie dormant in the soil for long periods in dry weather. When rain falls shoots are thrown out from the joints, and in a very short time a fresh area of the pest is well established.

When first noticed, every attempt should be made to prevent its spread. The infested area should not be cultivated and when possible it should be fenced off from the remainder of the paddock until the Johnson grass can conveniently be destroyed.

As pigs are fond of the thick succulent roots of Johnson grass, success has been achieved on many farms where the infested areas are small by securely fencing them off and turning pigs into the paddock. If the enclosure is handled in this way for a number of years, the pigs may destroy every vestige of the grass.

A quicker but probably a more expensive method of eradicating Johnson grass is by using a non-poisonous weedicide. Sodium chlorate may be applied, but commercial weedicides usually contain calcium chlorate as the killing agent. These substances are soluble in cold water, and are most economically applied as a light spray, for which the ordinary knapsack sprayer pump or some form of atomiser will be found suitable.

To get the best results Johnson grass should be sprayed when the plants are well out in flower. Further spraying may be necessary at a later date to kill out any regrowth.

Sodium chlorate is dissolved in water at the rate of 1 lb. per gallon. Commercial weedicides should be used according to the manufacturers' instructions.

O. L. HASSELL, Senior Instructor in Agriculture.

Sour Grass or Yellow Grass.

Within recent years the intrusion of sour grass into paspalum pastures in Queensland has been causing dairymen a good deal of concern. Sour grass is closely related to paspalum and is a native of tropical South America, now widely spread in moist tropical areas. It is a perennial grass, reaches a height of 1 to 2 feet, and spreads rapidly by means of creeping stems. Its foliage has a rather characteristic yellow tinge.

Sour grass is common on the Atherton Tableland and in wet coastal districts in North Queensland. Recently it has commenced to invade paspalum areas south of Gympie. As a fodder grass it is held in very low favour. Like the common mat or carpet grass, it has some value on poor soils, but when it invades paspalum pastures a decrease in the carrying capacity of the land is noticed.

Sour grass is similar in many respects to mat grass, and its control and eradication may in all probability be effected by the employment of measures which have proved efficacious in the handling of mat grass. The following recommendations are made:—

(1) Whenever small patches of the grass occur on a farm they should be dug out and the weed burnt.

(2) Where the invasion is too rapid to be stemmed by digging, a system of pasture management should be instituted which will allow the paspalum to grow sufficiently vigorously to keep the sour grass in check. This would involve subdivision of large paddocks, periodical renovation by the plough or pasture harrows, encouragement of clovers, and, possibly, topdressing.

(3) Cultivable pasture land invaded by sour grass could be ploughed and utilised for animal crops for two or three years prior to resowing with a pasture mixture.

(4) Smothering grasses, such as kikuyu and giant couch, may be grown in suitable areas with the object of keeping the sour grass in check.

(5) Where large patches of sour grass are involved the use of poison sprays would not be economical; small areas could no doubt be treated satisfactorily with sprays which are non-poisonous to stock (*e.g.*, chlorate sprays).

C. W. WINDERS, Assistant Agrostoligist.

SUPPLEMENTARY FEEDING OF STOCK.

Good foundations and framework are essential prerequisites to an elaborate building, and the same is true of a living organism. The skeleton or bony material must be well formed if it is to support the intricate mechanism of an active body. The skeleton is largely mineral matter, and of this material over 90 per cent. is composed of lime phosphate. During the intra-uterine period of its life and in the early sucking period, the young derives the whole of its mineral requirements from the mother. She in turn derives her supplies from the food she eats. When this is deficient in the required elements, nature enables her to draw upon her own reserves. Such is the overpowering force of maternity that a cow has been known to deplete her own body stores by 20 per cent. of their lime and phosphate content for the sake of the calf.

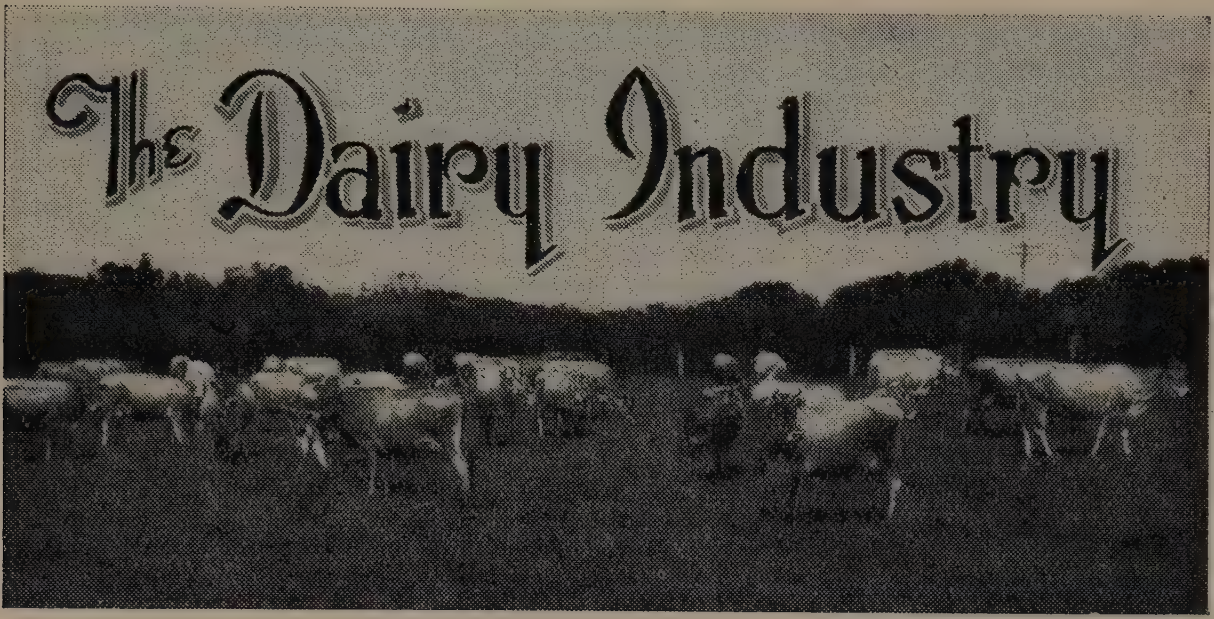
The growing animal and the producing mother require relatively large amounts of lime and phosphate to meet development on the one hand, and lactation or the needs of the unborn young on the other. The mature male or the unproductive female require much less.

As the mineral content of good pasture closely resembles that of animals themselves there is rarely any need to feed supplementary minerals when green grass is available. When the grass dies much of the inorganic (mineral) matter returns to the soil, and is unavailable to the animal. At this time the palatability of the grasses is affected, and stock are less inclined to eat all they require for maximum production. This reduced intake means a reduced mineral intake, and may lead to a temporary mineral deficiency. On certain types of country the soil, and consequently the vegetation it supports, is deficient in some minerals, and stock grazed thereon are in a constant state of malnutrition.

Under these conditions supplementary feeding becomes an economic necessity.

This has long been understood by the producer, but there has always existed some uncertainty as to the minerals required and the amount to be fed. On farm lands where the animals are under constant observation, and where the composition and palatability of the feed is known, the question presents little difficulty. On open grazing country complications arise. Apart from the requirements of the stock the difficulty of administration must be considered. The grazier cannot afford the individual attention to animals that farm stock get. He must aim at a mineral composition which corrects the deficiencies, and at the same time automatically limits the intake to the required amount. The problem is different for each locality, and results must largely depend upon the intelligent observation of the owner. In general, a mixture of well-graded steamed bone meal and coarse salt makes an efficient and palatable lick. The salt content should not exceed one-third of the composition, and where water analyses indicate it, the salt may even be excluded. A little appetiser must then be added to the bone meal. Price will govern which is to be used. The attraction which it holds for stock will determine the amount to be added. The quantity consumed will determine how often the material is exposed. When very fibrous food is being used it may become necessary to incorporate a purgative—5 per cent. sodium sulphate (Glaubers salt) is recommended.

Steamed bone meal should be fine, uniformly graded and of good analysis. The Department of Agriculture and Stock will report on samples submitted. Salt should be clean butcher's quality. On no account use second-hand material.—Dr. M. WHITE.



The Colour of Butter and Cheese.

O. ST. J. KENT, Research Laboratory, Dairy Branch.

IN controversies on butter quality, the subject of colour invariably arises, and much ado is made about the variation in appearance that sometimes occurs in butter from different districts or at different times of the year. The following notes are given in the hope that the colour of butter and cheese, and the factors influencing it, may be more fully understood.

A discussion on the colour of butter and cheese requires first of all a brief description of milk and its colour, since it is from this raw product that butter and cheese are made. Milk is composed of water and solids. In 100 lb. of milk there are 87 lb. of water and 13 lb. of solids. The solids are made up of fat 4 lb., milk sugar 5 lb., casein and albumin 3¼ lb., and minerals ¾ lb. Some of these solids are dissolved in the water in milk, whilst others are suspended in it just as clay is suspended in muddy water. All the milk sugar and albumin dissolve, whilst the fat, casein, and some of the minerals are suspended in the water portion of the milk. It is to the presence of these solids in suspension that milk owes its white or milky appearance, the milky appearance being caused by the scattering of reflected light by these suspended solids.

If different samples of milk are placed side by side and examined, it will be noticed that some are more tinged with yellow than others. This colour is due to the presence of a yellow colouring substance dissolved in the fat of milk. The yellow colour becomes more noticeable when the fat globules are concentrated in cream. It becomes still more apparent when the cream is churned into butter, and is most evident when one views the melted butterfat itself.

Skim milk also contains a yellowish colouring substance, which cannot be observed, however, until the milk is coagulated. When the curd separates from the whey, the colour of the whey is seen to be yellow with a distinct greenish tinge. This colour is caused by a colouring substance called lactochrome which dissolves in the watery portion of the milk.

Milk therefore is seen to contain two kinds of colouring substances—one which is soluble in fat and the other which is soluble in water. It is the colouring substance soluble in fat which is of interest to us, for it is this pigment which is present in butter and cheese. This yellow pigment found in butterfat is a very interesting and important substance. It is called carotin. It belongs to a group of colouring substances called carotinoids, which are very widely distributed in plants and are also found in many animals. Carotin, for example, is responsible for the yellowish colour of the fatty tissue and skin secretion of dairy cattle, especially Jerseys and Guernseys. Another carotinoid, which is very closely related to carotin and which is called lycopin, causes the red colour of tomatoes, watermelons, and other fruits, but has not been shown to occur in animals and certainly not in milk.

Carotin is found in all green plants, being manufactured by the plant itself, but it is not manufactured in the body of animals. The presence of carotin in milk fat is therefore due to a direct transfer of this colouring substance from the food eaten by the cow. This has been proved quite definitely by feeding experiments, which have shown that the amount of carotin in the fat increases or decreases, according to the amount of carotin present in the food. When cows are fed on such foods as cottonseed meal, timothy hay, white corn and yellow corn, the amount of carotin found in the milk fat is very low compared with that obtained from cows fed on green lucerne hay, green crops, fresh pasture grass, and similar foods.

Another interesting feature about this colour is that, of all mammals whose milk is commonly used for human food, cows alone give milk which has a pronounced yellow colouration of the fat. Milk fat from the goat, ewe, camel, and water buffalo is practically colourless, if not entirely devoid of colouring matter. The fat of human milk, however, is at times distinctly tinted by carotinoids. The reason why such differences occur is not known.

There is also a striking difference between the various breeds of dairy cattle with respect to the amount of this yellow colouring substance found in butterfat. Guernseys and Jerseys rank first in this respect, with Ayrshire, Shorthorn, and Friesians lower down on the scale.

In cow's milk the yellow colour will only be found provided that the food contains an abundance of carotin. This fact explains the seasonal variation in the natural colour of butter and also explains why butter from some districts is more yellow than butter from other districts. In those districts with a good annual rainfall, and consequently a plentiful supply of green pasture the colour of the butter is always brighter than that produced in the drier parts of the State. The colour of butter does not depend entirely on its carotin content, because there are many ways in which the colour may be altered. The pale creamy-coloured butter which is so well known in every household is the product of modern manufacturing methods. The butter-maker can control the colour within certain limits by altering his methods of manufacture. The temperature at which the cream is churned, the temperature of the water used for washing butter, the size of the butter grains, the length of time that the butter is worked, and the light of the factory, all have an influence on the appearance of the finished article. In some countries butter is artificially coloured, but in Queensland this practice is not carried out.

The consuming public have peculiar tastes for colours so far as dairy products are concerned. Queensland people at the present time demand very pale butter and look askance at any butter that has a bright yellow colour; yet on the other hand they seek highly coloured cheese, and look somewhat suspiciously at pale-coloured cheese. Generally speaking, there is nothing wrong with brightly coloured butter. In Queensland it usually signifies that the butter has been produced in a district where green pastures have been particularly abundant and is therefore a sign of goodness rather than a defect. In this respect the relationship between carotin and vitamins is of great interest. It has been shown recently that carotin can be transformed into vitamin A by the cow itself. The yellow colour of butter, such as is often seen in spring and summertime, is therefore suggestive of richness in vitamins, and the slogan "There is Sunshine in Australian Butter" is apt as well as attractive.

Occasionally butter develops quite abnormal hues. Green-tinted butter was reported a little while ago, and quite often butter with an extremely deep yellow colour is known to occur. These phenomenal butters can generally be traced to some unusual food consumed by the cows. It is well known that certain pumpkins will readily produce a deep rich yellow-coloured butter. Pale-coloured butter is also obtained from milk of cows approaching the end of their lactation period.

In the laboratory, colour of butter can be determined and colour values expressed in numbers. Furthermore, certain defects in butter are signalled by outstanding colour change. For example, a defect known as tallowiness is accompanied by a bleaching of the yellow colour of butter. Tallowiness is brought about by the oxidation of butterfat, and carotin on oxidation is known to lose its colour completely.

The colour of cheese is particularly interesting. Most cheese, unlike butter, is artificially coloured. The cheese manufacturers have to cater for the consuming public, and they colour their cheese accordingly. Cheese that is exported to England has to be either very highly coloured or not at all, and, in shipments overseas, the colour of cheese is either approaching brick-red or white. For the Queensland consumer a cheese of colour half-way between these extremes has to be manufactured. The so-called white cheese (actually a pale creamy colour) is naturally coloured cheese. Many consumers, in choosing a highly coloured cheese, doubtless believe they are securing a richer article than the white cheese, but such is not the case. The difference in colour in cheddar cheese, generally speaking, is due to the amount of harmless artificial colouring substance added to it.

The colouring substance used in cheese-making is called annatto. It is quite a harmless substance which is obtained from the seeds of the annatto plant, which is largely cultivated in India and America. The seeds when ripe are coated with a reddish powder, and it is this powder dissolved in suitable solvents that constitute the annatto solution used in cheese-making. It is very strong and only small quantities ranging from 1 to 4 oz. per 100 gallons of milk are necessary to colour the cheese.

In Queensland, cheddar cheese is our most common cheese, but there are hundreds of varieties of cheese manufactured in different parts of the world. Some of these have their distinctive colours—*e.g.*, the Dutch cheese or Edam cheese is known by its pink or red external coat. Some fancy cheeses, such as Stilton and Gorgonzola, have blue-green streaks running through them, and others are manufactured with many distinctive colour peculiarities.

Cheese, like butter, may have its appearance altered by contamination with yeasts and mould growths. On the exterior of cheese a great variety of colours, due to mould growth, may sometimes be seen, particularly in moist hot weather, but little harm is done provided the rind of the cheese is intact. On the interior of cheese, bacterial defects may give rise to multi-coloured sections according to the type of contamination.

The colour of butter and cheese may not have such a strong commercial appeal as the flavour and aroma of these products, but it certainly plays its important part in the distribution of these valuable articles of diet.

In conclusion, it is hoped that in future Queenslanders will not treat a bright-coloured butter or a pale-coloured cheese with any undue suspicion. It may be stressed again that in this State no colouring substance whatever is added to Queensland butter.

Paspalum Ergot.

Paspalum is still the most popular summer-growing pasture grass in the coastal dairying districts. The widespread occurrence of ergot in this grass is therefore of considerable importance, since its presence may lead to sickness in stock.

The disease is first seen as a dark sticky exudate on the heads oozing from the developing seed. This exudate is due to the activity of a fungus parasite and contains countless spores or minute seed-like bodies by means of which the disease is spread from plant to plant by animals and insects.

Under suitable conditions, the stage described above is followed by the formation of resting bodies or sclerotia on the seed heads. The sclerotia are globular, about $\frac{1}{8}$-inch in diameter, and consist of compact fungus tissue. They are yellowish grey in colour and give the infected paspalum head an irregularly swollen appearance.

Paspalum ergot is closely related to ergot of rye, and, like it, is poisonous. The summer stage characterised by the sticky exudate contains little, if any, of the poisonous principle. The poison is produced in the sclerotia, and becomes concentrated as they get older. The symptoms produced in cattle resemble staggers. The poisoning does not usually result in the death of the stock, but losses may occur due to bogging of cattle in their weakened condition or to starvation if they are unable to rise.

The eradication of a disease of this nature from pastures is a very difficult problem. It can be kept in check, however, by the adoption of intensive rotational grazing, thereby largely preventing the formation of seed heads. Where a mower can be used this provides a supplementary means of getting rid of the seed heads before they form sclerotia. If, in addition to mowing, a quick fire can be got through the cut grass the disease may be eradicated—at least temporarily. If badly diseased grass gets out of hand it should be burnt over at the first opportunity. Where difficulty is encountered in dealing with this disease serious consideration must be given to the replacement of paspalum with kikuyu or other suitable grass.

R. B. MORWOOD, Pathologist.

Flushing the Separator.

The test or percentage of fat required in cream should be not less than 38 per cent. during the hot summer months and not less than 34 per cent. during the cooler months of the year. Whatever make of separator is used, during the process of separating satisfactory results can only be obtained when the cream screw is adjusted so that the driven speed of the separator conforms with the corresponding number of revolutions per minute recommended by the maker of the machine.

At the completion of separating, flushing with cold or warm water so as to remove the last of the cream from the patties is an undesirable practice. If the cream bucket is not removed during the process, some of the impurities and slime adhering to the bowl may be removed and deposited in the cream. This applies particularly if warm water is used. When separated milk is used for flushing, excessive milk solids are introduced into the cream and these will act as a starter and affect the quality. Thus the proceeds of flushing should be fed to the pigs or calves on the farm. The maintenance of cream quality is too important to be impaired by laxity in this respect.

T. DOUGLAS, Inspector of Dairies.

Cleanliness in the Milking Shed.

Observations during milking operations on dairy farms in many cases reveal unclean habits, dangerous from a viewpoint of infection from germs and bacteria. Bacteria in milk and cream are well-known causes of low-grade, inferior products, and safeguards against their introduction into dairy produce are essential.

The milking bucket should on no account be used to wash the udder and teats of the cow or the milker's hands. The act of washing the udder transfers innumerable bacteria with the dirt and loose hair to the bucket, and a simple rinsing in cold water is not sufficient to remove them all. The need for separate milking buckets and washing buckets is therefore very obvious.

Receptacles with water for washing the cow's udders and also the milker's hands before milking each cow, and cloths for wiping them, are a necessary adjunct to cleanliness. The dairyman may well ask himself the question: "Would he take his meals with hands unwashed after completing milking operations?" The answer would be an emphatic "No!" Yet the cleanliness of his hands during milking is at least as important, for milk and cream are readily contaminated foods. Clean hands are just as essential during milking as at meals, and it is therefore curious that many people who are scrupulously clean in the home are lamentably careless in the cowyard and dairy.

Another very common practice is the wiping of soiled, milky hands on the clothing. These same clothes, if worn throughout the day, soon acquire a most objectionable smell and attract flies. Sugarbag aprons, which are easily made, inexpensive, and long-wearing, should be used by all milkers and frequently washed to obviate the unpleasant presence of stale milk on the clothing.

The protection of milk against flies is also a matter for consideration. Most dairymen have in use the large, flat milk vat, and this should be provided with a lid in which an opening has been left for the milk strainer, or, if milking machines are in use, for the releaser. This lid keeps out dust and vermin, and also assists in maintaining the temperature of the milk prior to separating.

Hand milkers frequently moisten the cows' teats during milking from the milk in the bucket. This practice cannot be too strongly condemned, as the hands are usually soiled, and bacteria from the udder of the cow are transferred to the bucket.

The following points are all practised by the most successful dairymen:—

Wash the udders in buckets used only for that purpose.

Wash the hands after milking each cow.

Wipe the hands on a clean cloth, not on the clothes, and wear either an apron or overalls.

Aprons and overalls are easily boiled, so keep them clean.

Don't use an uncovered vat. A cover is required by the Dairy Produce Acts.

E. C. DUNN, Inspector of Dairies.

Inferior Grade Cream.

One of the most common sources of the contamination of cream, and one that is often overlooked, is the badly washed cream can.

More cream is spoilt by being stored or carried in a badly washed can than by most other ways. This applies to cans in good order as well as those that are dented and rusty.

The reason is not far to seek. Hundreds of cans pass through the same rinsing water of the mechanical can-washer at the butter factory daily, and although a final steaming is carried out in the last stage of the washing process, it is not of sufficient duration (nor is it practicable) to thoroughly sterilise all of the cans thus treated.

Cans that have contained second-grade cream due to bacterial activity, such as cheesy and rancid flavoured cream, may continue to spoil future consignments unless attended to. Many cream cans carry a definite tallowy smell and the defect is sometimes traceable to this cause.

In order to safeguard the quality of cream it is advisable to rinse all cans on their return from the butter factory with boiling hot water to which a little washing soda has been added. The cans should then be rinsed with clean boiling water to remove all traces of the soda.

Thoroughly cool and aerate the cans in a clean atmosphere before using again. Do not rinse with cold water or wipe the insides of cans under any consideration.

C. L. MORAN, Instructor in Dairying.

Feeding of Calves.

About 87 per cent of cows' milk is water. Of the remainder, nearly one-third is fat, and a good separator, if properly operated, will remove about 95 per cent. of this fat. Very little protein is removed. It follows that if the separated milk is to be made equal in feeding value to the original milk, either the fat or its equivalent must be replaced. There is no need to replace protein, and for this reason it is not good practice to feed such protein-rich materials as linseed meal in conjunction with skim milk to very young calves.

Dripping obtained from a reputable meatworks, or cod liver oil, may be incorporated in the milk, but they are rather expensive and difficult to mix properly. A better system is to use finely ground maize. Maize meal from good-quality grain contains as much as 5 per cent. high-grade oil and 70 per cent. of easily digested carbohydrate which, to some extent, serves the same purpose as fat.

The new-born calf should get whole milk for a fortnight if it is to be given a good start in life. For the first few days it may be fed three times daily; after that, twice daily is enough. A safe level to feed is 1 gallon to each 100 lb. liveweight. At the end of the second week a little maize meal is stirred into the milk and the change to separated milk begun. By the end of the third week the maize meal may be built up to a handful, and the change to separated milk completed. By the end of a month the calf begins to nibble grass, and can consume about ½ lb. of meal.

From now on to the eighth week the milk can be replaced progressively by water and a meal mixture. By the eighth week the calf will be able to eat up to 2 lb. daily of a suitable meal mixture.

Such a mixture may contain 35 lb. of linseed meal and 65 lb. of a cereal meal. Pollard and bran should not constitute more than one-half of the cereal meal. The remainder may be crushed oats, barley, or maize. About ½ lb. of salt and 2 lb. of sterilised bone meal should be included in the mixture.

As the animals take more grass or hay, the supply of the meal mixture is restricted. At six months, unless an adverse period is encountered, the calf should be able to fend for itself.

Dr. M. WHITE.

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MILK AND CREAM TESTING EXAMINATION.

An examination will be held for certificates of proficiency in milk and cream testing and milk and cream grading on Saturday, 24th July, 1937; and in butter making and cheese making on Saturday, 31st July, 1937. The examination will be held in convenient centres. Candidates should notify the Under Secretary, Department of Agriculture and Stock, Brisbane, not later than the 5th July.

Entrance fee 5s. for each subject should accompany the notification, with an additional 10s. 6d. if a special country centre is desired as the place of examination.

Candidates must not be less than 18 years of age on the day of examination.

Does Manuring Pay?

H. W. KERR and G. BATES.*

SO many of our canegrowers have long known the absolute necessity for the use of fertilizers, if they are to maintain the productivity of their land, that the above question would to them appear superfluous. But there are a number of farmers who have still to learn the true value of these sources of plantfood, as an aid in reducing costs of production, and in restoring fertility to the land; and it is to those growers that we would present the striking results obtained from a fertility trial conducted on the farm of Messrs. S. J. Page and Son, of Edmonton, North Queensland.

This trial has now been continued for four years, and full yield data are available for the plant and three ratoon crops. The soil type is rather poorly-drained schist loam, which was producing inferior crops at the time the present owner entered into occupation. The use of the mole-drainer and tractor-grubber, combined with good husbandry, has so improved the general condition of the land, that it is able to maintain good cane tonnages, *provided it is supplied with the plant-foods which it so seriously lacked in its initial state.*

The land was considered as suitable only for the growth of Pompey, which variety was planted accordingly. The block had received a thorough preparation prior to planting. The trash from the old ratoons was ploughed under, and crushed limestone was broadcast at the rate of 2 tons per acre. A heavy crop of legumes was subsequently grown and turned into the land. Finally, the field was deeply grubbed just before the cane was planted.

The fertilizers applied on the experimental areas consisted of combinations, in pairs, of the following:—

N—420 lb. sulphate of ammonia per acre.
P—270 lb. superphosphate per acre.
K—150 lb. muriate of potash per acre.

One series of five plots received the full fertilizer application, amounting to 840 lb. of mixed fertilizer per acre, while a further set was given no manure of any kind throughout the experiment.

The crop yields for the four years were as follows:—

Crop Yields, 1933-1936.

Crop.	No Manure.	Sulphate of Ammonia + Superphosphate.	Sulphate of Ammonia + Muriate of Potash.	Superphosphate + Muriate of Potash.	"Complete" Fertilizer.
	Tons.	Tons.	Tons.	Tons.	Tons.
Plant cane	28·2	31·3	34·4	34·8	37·0
First ratoon	13·4	22·6	26·8	17·5	29·6
Second ratoon	11·9	21·6	22·9	13·4	25·5
Third ratoon	13·2	23·1	29·9	15·9	32·9
Total yield—4 crops ..	66·7	98·6	114·0	81·6	125·0
Average yield per crop ..	16·7	24·7	28·5	20·4	31·3

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* In "The Cane Growers' Quarterly Bulletin" (Bureau of Sugar Experiment Stations).

Discussion of Results.

The above results present certain striking features. Following good preparatory treatment of the land—not overlooking, of course, the green manure crop—the unfertilized land yielded quite well, though the benefits from the manure on the fertilized plots were already evident. The value of the early treatment had, however, entirely disappeared before the growth of the first ratoon crop. The serious lack of available nitrogen, in this humus-deficient soil, was a very potent factor in rendering the unfertilized ratoon crops almost a complete failure, while superphosphate and potash also exerted their influence on the "complete" manure plots.

This low level of productivity on the unmanured area persisted throughout the trials, though the fertilized plot yields reflected the seasonal climatic conditions. The beneficial growing season just experienced resulted in a third ratoon yield of almost 33 tons per acre, where the land was suitably fertilized, while the unmanured crop was but 1½ tons in advance of the second ratoon yield of 1935. The trend of yields due to the several treatments is strikingly illustrated in the accompanying graph (Plate 171).

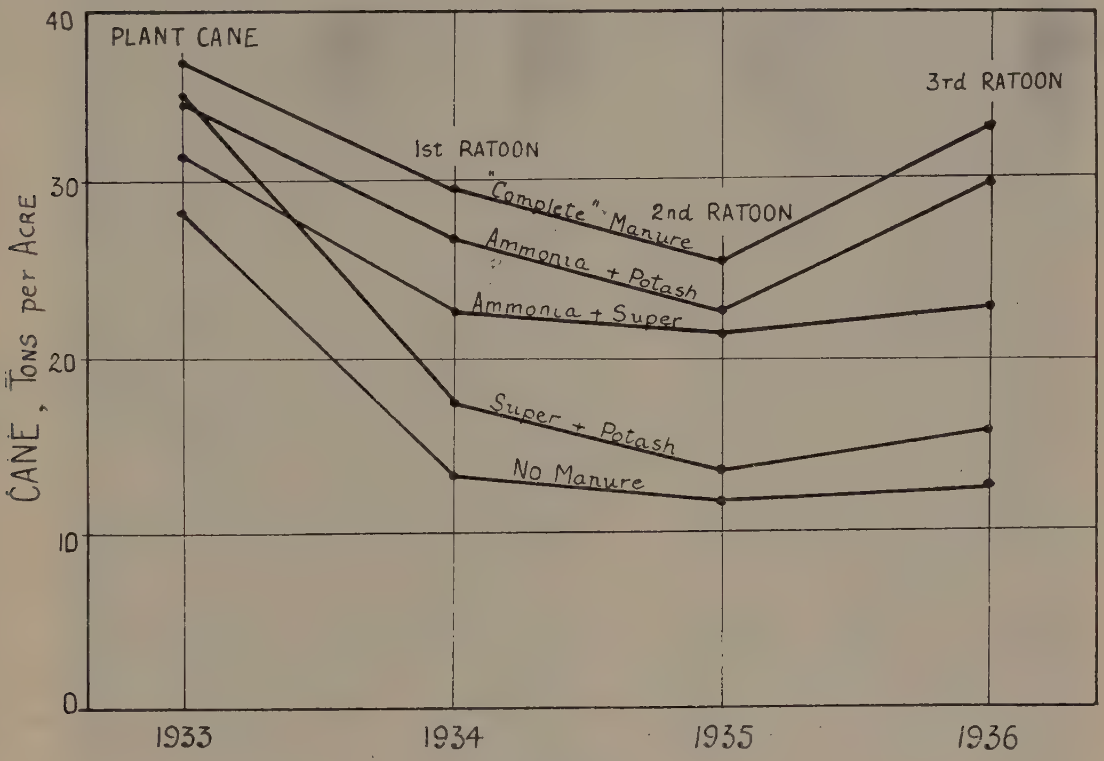

Plate 171.

A graphical presentation of the yield data for plant and ratoon crops.

Finally, a study of the average yields for the four crops show that the unmanured cane yielded 16·7 tons per acre, while the fully-fertilized crop gave an average of 31·3 tons per acre.

Recommendations.

The above returns indicate very clearly the natural deficiencies of the schist lands of North Queensland, where they constitute a major soil type. Profitable crop yields will be obtained only where due regard is paid to the plant-food applications given in the form of suitable artificial manures. An initial application of 4 cwt. per acre of Sugar Bureau

No. 2 or No. 3 Mixture provides the crop with an abundance of phosphate and potash, and subsequent top dressings of sulphate of ammonia (up to 4 cwt. per acre for ratoons), supply the necessary available nitrogen in which the land is so seriously lacking.

It should not be necessary to stress that on soils of this character, the benefits from green manuring during fallow are strikingly reflected in plant cane growth, and incidentally, eliminate the need for heavy manuring with sulphate of ammonia for that crop.

Plate 172.
Queen Mary Falls, near Killarney, South Queensland.

Does Cultivation Conserve Soil Moisture?

N. J. KING.*

THERE are four means by which moisture may be lost from the soil:—(1) drainage, (2) transpiration through the cane leaves, (3) transpiration through weeds and grasses, and (4) evaporation from the surface of the soil. The farmer has no control over the first two, and the third is attended to by cultivating and chipping until the cane is out of hand. It is the purpose of this article to discuss the fourth—evaporation losses. Farmers for generations have adopted the practice of preparing a surface mulch to prevent moisture losses, and a great many of our cultivation implements are designed to break up the first inch or two of soil and so produce the desired loose surface. This operation has a two-fold object—in destroying weeds and in creating the loose mulch with the idea of moisture conservation. But there are times of the year when weed control is not necessary, and yet after rain the grower scarifies the farm to mulch the surface and prevent undue evaporation of moisture.

The theory behind the practice is that moisture rises in the soil by capillarity and is evaporated by sun and wind on reaching the surface; the mulching, by destroying the capillary channels and forming a loose surface, thus prevents the moisture from arriving at the surface.

Some work carried out by the writer in 1933 had indicated that the upward movement of water by capillarity on the Woongarra soil was practically nil, and this observation prompted the investigation as to whether surface cultivation was of any value in preventing evaporation.

An experiment was initiated to obtain information on this point. Portion of a block under bare fallow was divided into four portions. Section (1) was hand hoed to a depth of two inches to maintain a surface mulch; section (2) was left bare—just as flattened down by the rains—but weeds were hand picked to maintain comparable conditions with (1); section (3) had a close cover of corn sacks in an attempt to prevent surface evaporation altogether; and section (4) had a cover of trash to measure its efficiency as a mulch as compared with the sack and soil mulches. Borings were carried out on these four sections every two or three days to a depth of four feet, and the moisture determined in 3-inch and 6-inch sections over the total depth. The experiment was started immediately after the April rains and continued until 2nd May, during which period no rain fell.

It is noticeable in examining the results (Plate 173) that the soil under the sack cover lost the least moisture by surface evaporation. The complete table of results obtained shows that very little difference exists between the bare surface plot and that which had a hoed surface. In fact the aggregate of all determinations proves that slightly less moisture was present in the hoed plot than in the other, due to the more rapid drying out of the surface two inches of mulch. The plot under the trash cover retained, on the whole, slightly more moisture in the surface two feet than that under corn sacks.

Two outstanding facts are discernible from this work. The first is that surface scarification as a means of conserving moisture is valueless on this soil type, and is uneconomical unless weeds are sufficiently bad to warrant removal. The second is the decided advantage of the trash mulch in moisture economy. It has been mentioned to the writer that after rain on this and other soils the sun tends to form a crust on the surface, and that scarification is necessary if only to break up this crust. In the writer's opinion the only harm this crust can do is to prevent or render difficult the coming through of young shoots after planting. It is certainly recommended that the crust be broken at this stage to allow young shoots through, but later on even the breaking of the crust would serve no useful purpose.

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* In "The Cane Growers' Quarterly Bulletin" (Bureau of Sugar Experiment Stations).

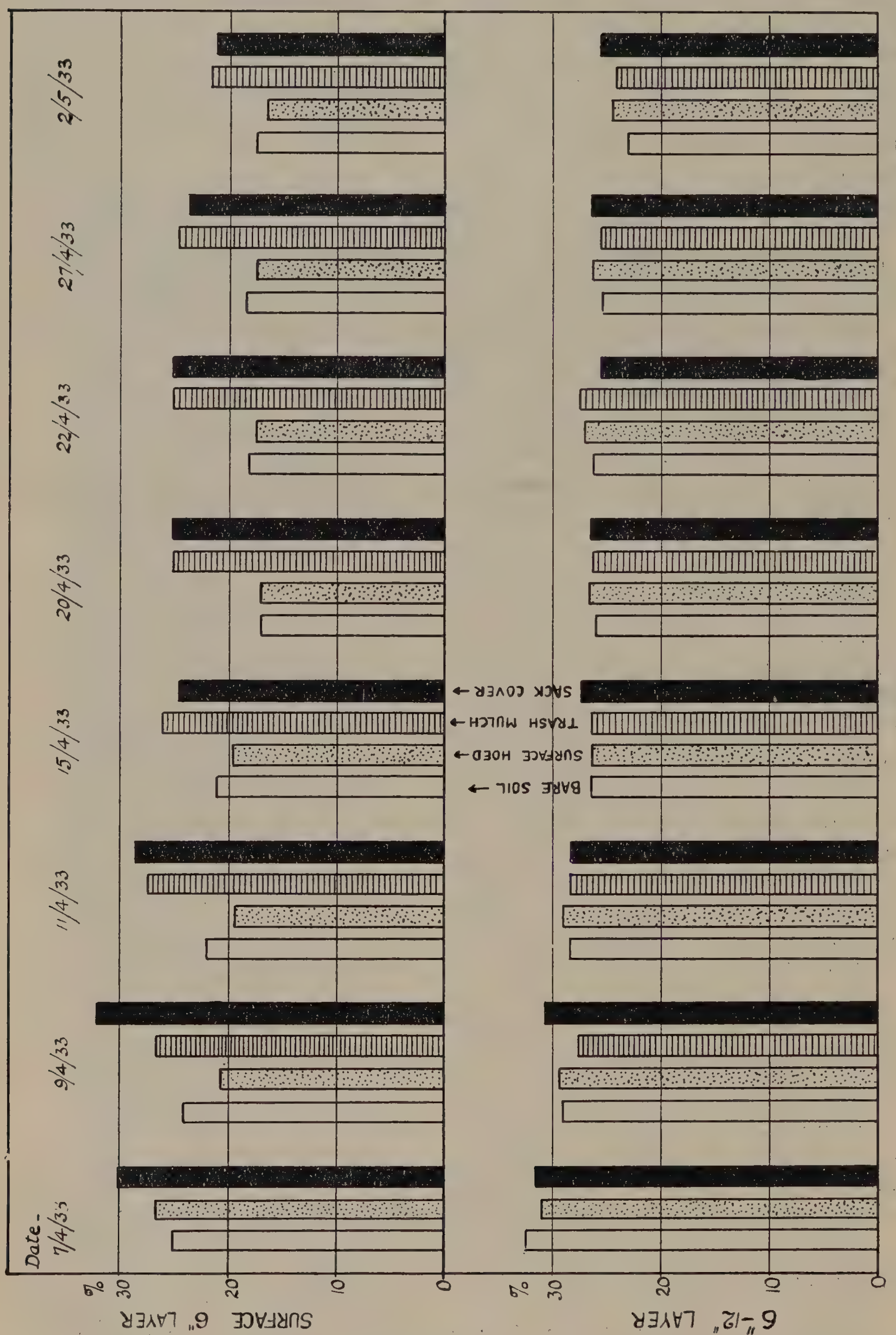

Plate 173.

A selection of the soil moisture data presented in graphical form. The influence of soil treatment is particularly noticeable in the surface 6" layer.

The results of this study were so directly opposed to popular belief that it was thought necessary to confirm them. Consequently the experiment was repeated in October, 1933, with exactly similar results. Since then publications from overseas have shown that identical conclusions have been reached in other parts of the world. The theory of mulching to prevent moisture losses by capillarity was supported strongly by F. H. King and E. W. Hilgard some 40 years ago. Since then Veihmeyer in California, Rohmstroff in Odessa, Call and Sewell in Kansas, and the Office of Dry Lands Agriculture in Washington have all found that the loss of moisture is practically the same from mulched as from unmulched surfaces; in some of the cases the mulched surfaces lost more moisture. The apparently contradictory results are explained as follows:—(1) It is found that where a water table exists within approximately six feet of the surface, capillarity effects, and consequently evaporation losses, are high. (2) Where the water table is below the six-feet level the effect of capillarity is not sufficient to cause large evaporation losses from the surface. In example (1) a surface mulch produced by cultivation implements would reduce the moisture loss, but in (2) the surface mulch would be useless.

Not many Queensland cane soils have a water table within the first six feet, so that scarification *for the sole purpose of conserving moisture* must be considered an uneconomical procedure.

QUEENSLAND SHOW DATES FOR 1937.

May.

Ipswich	11th to 14th
Roma	11th to 13th
Wowan—	
Show	11th and 12th
Rodeo	13th
Crow's Nest	Postponed to August
Gayndah	12th and 13th
Murgon	12th to 14th
Goomeri	18th and 19th
Mitchell	19th and 20th
Biggenden	20th and 21st
Gympie	20th to 22nd
Warrill View	22nd
Kilkivan	24th and 25th
Maryborough	25th to 27th
Charleville	25th to 27th
Gin Gin	28th and 29th
Toogoolawah	Postponed
Kalbar	29th
Childers	31st May and 1st June

June.

Bundaberg	3rd to 5th
Biloela	3rd to 5th
Lowood	4th and 5th
Boonah	9th and 10th
Gladstone Jubilee Show	10th and 11th
Marburg	18th and 19th
Rockhampton	22nd to 26th
Mackay	29th June to 1st July

July.

Kilcoy	1st and 2nd
Bowen	7th and 8th
Ayr	9th and 10th
Rosewood	9th and 10th
Pine Rivers	9th and 10th
Cleveland	9th and 10th
Townsville	13th to 15th
Nambour—	
Show	15th and 16th
Campdraft	17th
Esk	16th and 17th
Charters Towers	20th to 22nd
Laidley	21st and 22nd
Maleny	22nd and 23rd
Cairns	27th to 29th
Gatton	28th and 29th
Emerald	28th and 29th
Caboolture	30th and 31st

August.

Crow's Nest	4th and 5th
Home Hill	6th and 7th
Royal National, Brisbane	16th to 21st

September.

Imbil	3rd and 4th
Ingham	3rd and 4th
Pomona	10th and 11th
Tully	10th and 11th
Rocklea	11th
Innisfail	17th and 18th
Malanda	22nd and 23rd

October.

Ravenshoe	8th and 9th
Millaa Millaa	1st and 2nd

November.

Murwillumbah	3rd and 4th

The PIG FARM

Charcoal for Pigs.

DIGESTIVE efficiency in farm animals depends largely on their capacity for grinding the food in small fragments. Thorough mastication is therefore linked with ease of digestion. Some animals may eat food rapidly without ill-effects. Thus the domestic fowl swallows quickly, but it has a remarkable mechanism in the gizzard for grinding the food to a fine state for subsequent digestion and absorption.

The pig is not so well equipped as the fowl to handle rapidly-eaten food, yet under most farm conditions fast eating is the rule. The pig can be helped to make better use of its foods in the following ways:—

(i.) By feeding easily digested material;
(ii.) By grinding the less digestible foods;
(iii.) By ensuring the animals sufficient feeding room;
(iv.) By arranging for some open grazing where the animals may eat at their leisure;
(v.) By feeding aids to digestion.

It is the last with which this article is concerned.

Charcoal and coke are extremely cellular materials and possess a great number of surfaces. At these surfaces rapid digestion of food can take place. By feeding either of them in powdered form, coarse lumps of food become coated with a film possessing an actively digesting surface.

An alternative and cheaper method is to throw coarse charcoal or coke into the pig sty and let the animals grind and eat as they feel inclined.

DR. M. WHITE.

Horticultural Notes

Passion Fruit Growing on the South Coast.

J. McG. WILLS, Fruit Branch.

[*Continued from page* 419, *April*, 1937.]

WHATEVER method of cultivation is adopted, it is essential that the surface soil be broken up thoroughly at least once each year.

Where horse or tractor-drawn implements are used it is a simple matter to maintain a high standard of cultivation. On the steeper and rough locations, as well as on land which has not been stumped, cultivation, must, of course, be done by hand.

The soil should be well broken up to a depth of at least six inches, and this is best achieved by the use of mattocks or pronged forks. Light chipping with hoes will keep surface weed growth under control, but is of little assistance in maintaining the soil in a good state of tilth. This soil condition is essential for sucessful fruit production. By maintaining a good state of tilth moisture is conserved, the land is aerated, plant food is made more readily available, natural drainage increased, and control of pests and disease greatly assisted.

Vines must be kept growing and well cultivated from the start. They will then develop rapidly and come into bearing early. Vines insufficiently cared for when young become checked and subsequent development lacks vigour and does not produce the growth necessary to carry a profitable crop of fruit, while a greater amount of time must elapse before the vines commence to bear fruit. Older vines will also be retarded during hot dry spells and unfavourable seasonal conditions if cultivation is neglected. Under such conditions, weed growth becomes a serious competitor with the vines for the available soil moisture.

During the hot dry period of the year keep the soil well worked and weed growth in control. This will assist the vines materially to withstand the dry season, the whole supply of soil moisture will be available and should be ample to satisfy the plants' requirements.

On very stony ground cultivation will probably be confined to hand-pulling the weeds and chipping any clear spaces.

Plate 174.
A vigorous young vine two months after transplanting.

Cover crops, preferably legumes—such as cowpea, Poona pea, and vetches—should be planted between the rows in ample time to provide a good surface cover before the wet season sets in; or, if cover crops are not planted then, close-growing weeds should be permitted to remain until the heavy seasonal rains have passed. Such weed growth or cover crop will prevent the washing of surface soil, while if kept in check and not permitted to seed no harm to the vines will result, for at such a time there is ample moisture to support all the plant growth. After the wet season is over and the surface is dry enough to commence cultivation, all cover crop growth should be turned under, thus providing a valuable addition of humus and enriching the soil with valuable plant food.

FERTILIZING.

To be grown successfully, the passion vine, in common with most other vigorous growing plants, requires an abundance of readily available plant food.

If grown on good virgin scrub or forest land, ample plant food should be available for the first year or two.

On poorer soils and areas which have been under bananas for several seasons, a certain quantity of fertilizer will be required to provide plant food and maintain fertility.

Wherever farmyard manure is available, this should be collected for use in the vineyard, for even in small quantities it has a beneficial effect through the addition of humus and increase of the bacterial flora in the soil.

Use per acre in accordance with the quality of the soil a mixture of—

1 to 2 cwt. nitrate of soda;
4 to 8 cwt. blood and bone manure;
1 to 2 cwt. superphosphate; and
1 to 2 cwt. sulphate of potash.

With bearing vines, the manure should be broadcast and worked well into the soil. For younger vines, it should be applied close around the plant and well worked under.

Quick-acting nitrogenous fertilizer in the spring, or after pruning, will quicken new growth in the vine. Nitrate of lime or nitrate of soda applied at the rate of 1 cwt. per acre would be suitable for the purpose. The fertilizer is best applied in two dressings during the year—one, say, in July or August, and another in December or January.

PRUNING.

It cannot be guaranteed that pruning will increase the bearing capacity of the vine, but some control of growth must be practised if the vineyard is to thrive.

The principle reasons for pruning are:—

To keep the vine in good health.

To remove diseased, dead, and unprofitable growth.

To keep the growth in check on the wires in order to admit light and air and prevent congestion.

To induce the production of healthy, vigorous wood on which high-grade fruit is set.

To replace spent, bare leaders by the development of new ones.

To keep the lateral growth clear of the ground and properly spaced.

To regulate the time of bearing so that the highest market prices are obtained for the fruit.

To assist disease control and increase the life of the vine.

If left unpruned, vines soon become a tangled mass of wood and foliage in which fungus diseases may develop and rapidly shorten the life of the vine. It is essential, therefore, that an open habit of growth, admitting plenty of light and air, is maintained. All dead and diseased wood should be cut away and burnt so as to reduce risk of brown spot infection. Healthy, vigorous leaders and laterals produce the highest-grade fruit. The shortening back of lateral growth forces the vigour of the vine into the production of sub-laterals, thereby increasing the bearing surface and keeping the growth clear of the ground.

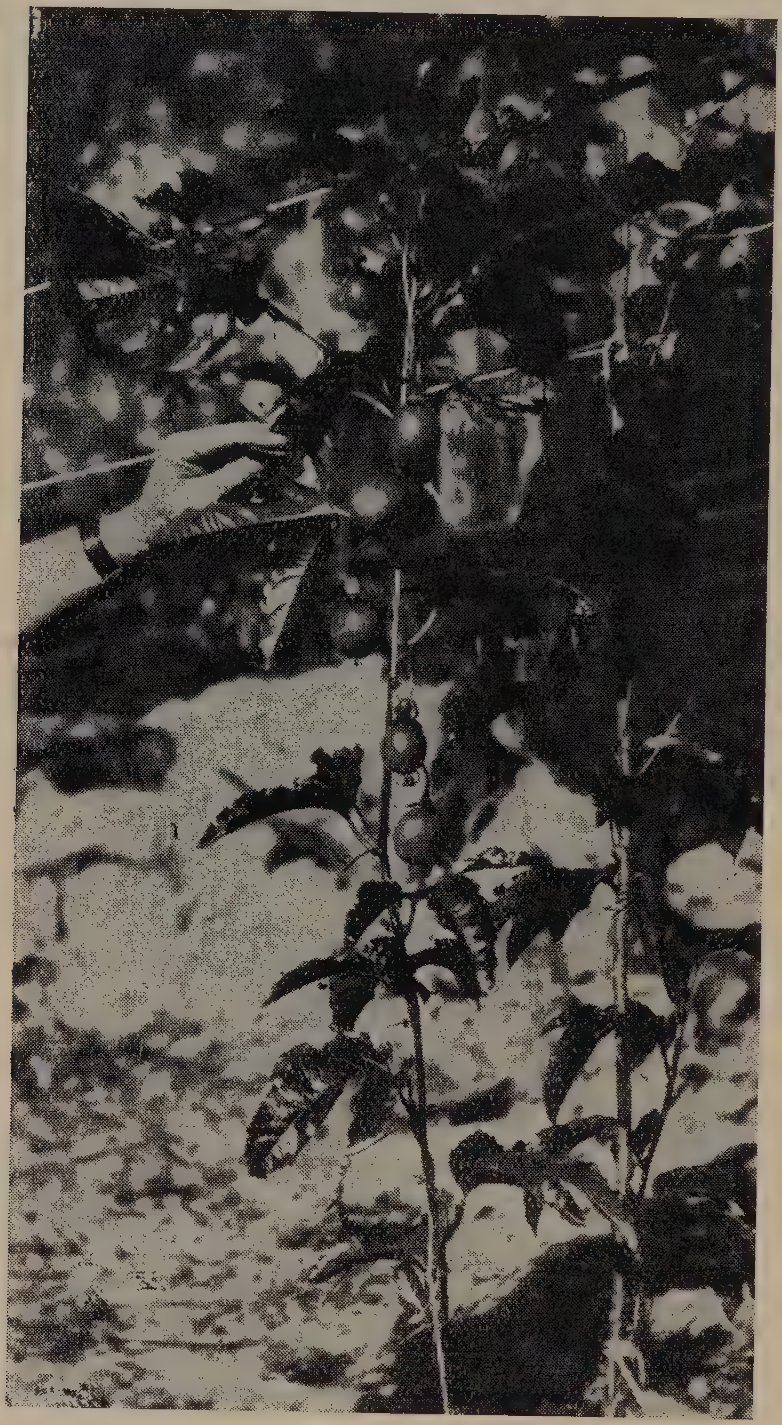

Plate 175.

A precocious young vines six months after transplanting. Note the fruits and twin stems.

Where laterals are permitted to trail over the ground the fruit may become scarred and otherwise blemished.

Pruning is a slow and tedious job, but if done well and carefully the grower will be repaid for time expended. Patience and intelligence are essential, for each vine may present a different problem to the pruner, and if the best results are to be obtained he will need to consider carefully its individual characteristics.

There is no hard and fast method of pruning for every grower's guidance. As a general recommendation, however, all dead, diseased, and weak wood, together with spindly, unthrifty, and non-bearing laterals, should be removed from the vine. Cut out all spent, long, bare leaders to induce the growth of healthy, vigorous ones in their place. Short, spindly laterals seldom bear fruit and only increase the density of foliage. Where laterals are shortened they should be cut back to a live, well-developed bud or shoot about 9 to 12 inches from the leader. Cutting back too severely is inadvisable, and may affect the new growth and bearing capacity of the vine. Where laterals are too numerous they should be thinned out to about 9 inches apart along the leaders.

All pruning tools should be sharp and in good condition and all cuts cleanly made.

Before attempting pruning or handling of the vines in any way precautions should be taken to prevent the spread of woodiness, in accordance with the recommendations of J. H. Simmonds, Senior Plant Pathologist, given in the pamphlet referred to at the end of these notes.

To enable the pruner to sterilize his hands and pruning tools readily and systematically, he should wear an apron with two pockets. In one pocket secateurs, knife, and other necessities can be carried, and in the other a piece of cloth soaked in 5 per cent. phenol or some equally effective sterilizing agent.

As soon as the operator has finished handling one vine and before commencing work on the next hands and pruning tools should be wiped thoroughly with the disinfectant. This action is soon performed almost subconsciously as a matter of course.

The passion vine should be pruned at least once each year, although two moderate prunings are preferable to one severe cutting. Some growers prefer to prune heavily during late winter and lightly after the main summer crop has been harvested, about February. Others prefer to reverse this procedure and prune lightly during the winter. Which method is adopted depends largely on local conditions, and is a matter for growers to experiment with. In any event it should be remembered that vines should never be pruned heavily during dry weather.

For the purpose of disease control, heavy winter pruning is preferable, as spraying is recommended by Simmonds during the summer months. It naturally follows that if the vines are well thinned out and cut back during the winter a better spray cover will be possible and the task made simpler and cheaper.

Light pruning at any time of the year will cause the vine to put forth new growth, and the development of this new growth regulates the production of fruit and its maturity according to the season in which it is performed.

When a summer crop is desired light pruning should be done during July and August, before the appearance of the spring growth. This will cause the vine to burst forth into new growth on which the summer crop will set. Pruning done at this season means, however, the sacrifice of portion of the winter crop, for harvesting will not be completed and the fruit remaining when the laterals are cut back is lost.

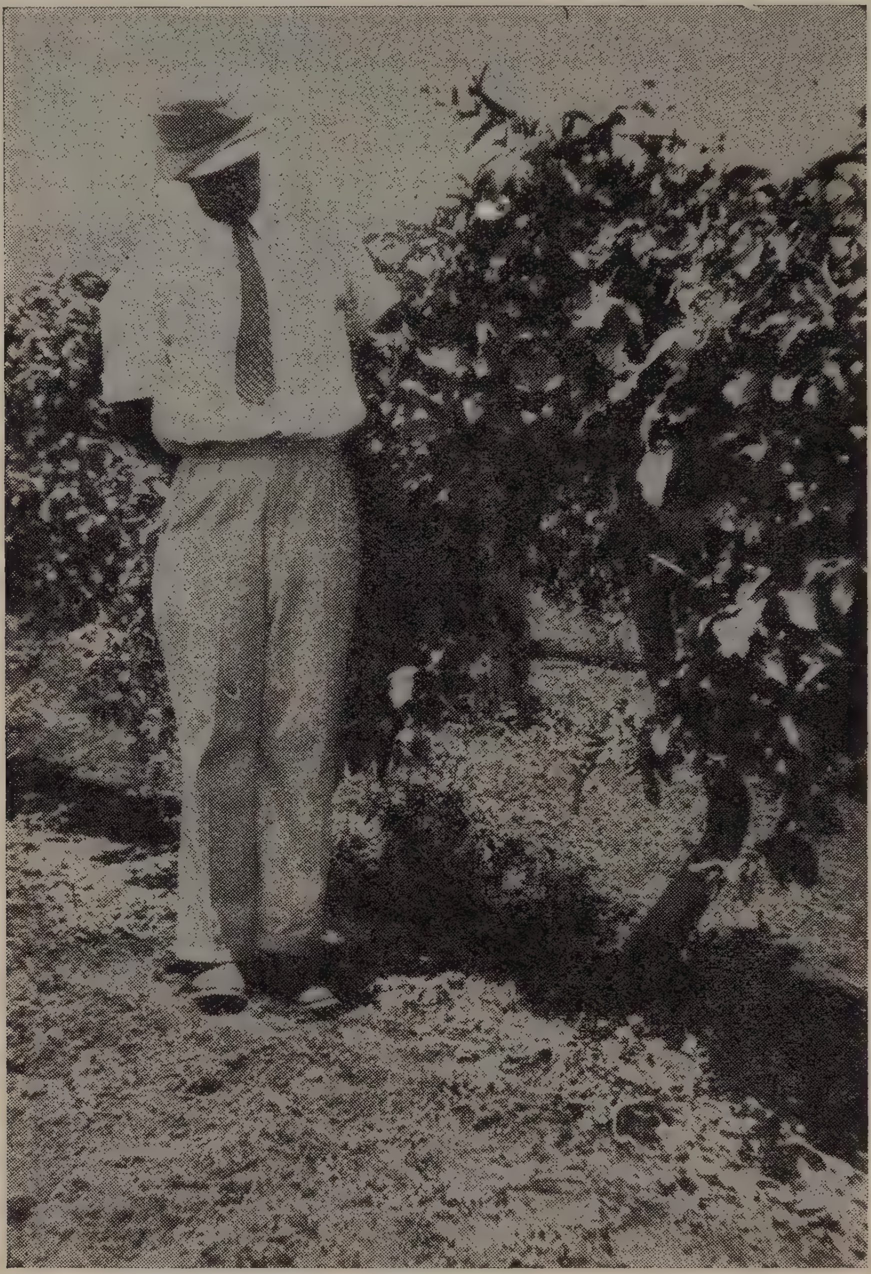

Plate 176.

A six-year-old vine two months after pruning. Note the dense growth of new fruiting laterals.

The intermediate or autumn crop is produced by shortening back the flowering laterals between October and the end of November. This action means sacrificing the bulk of the summer fruit, and is only warranted if weather conditions are favourable for an intermediate crop. A late winter crop will be produced if the flowers for the autumn crop are pruned off during February.

In warm localities the vine puts on vigorous growth much earlier than in exposed and colder parts of the district. The grower is advised to note carefully his own local conditions, and prune to suit that particular situation, as growth varies considerably between vines planted on lowlands and those in upland vineyards. Sound judgment is an essential factor in pruning. The grower can only acquire this through practical experience and a careful observation.

REPLANTING.

As the commercially useful life of a passion vine is generally about four years, if a grower wishes to continue some provision should be made for continuity of production. This may be done by rotation and by replanting.

Under normal vineyard conditions the heaviest crops will be produced when the vines are from two to two and a-half years old, after which they gradually decline in production and quality of the fruit. In order, therefore, to keep up a supply of good-quality fruit, new vines should be coming into bearing every two years.

Young seedlings may be planted midway between the older vines, and after the summer crop has been harvested every second vine may be cut out and the new vines trained on the trellis in the vacant space. As they come into bearing the remaining older vines should then be replaced, in turn, by fresh seedlings.

Although this method gives a replanting every two years, and a fairly high grade of fruit is produced, it has the disadvantage of necessitating an increased amount of pruning and spraying, as the young vines become infected with brown spot and woodiness to a much greater degree than if planted out in a fresh area.

By rotation areas can be kept isolated from each other either by distance or natural vegetation. Young seedlings planted out do much better under this system. They are not so much exposed to infection from diseased neighbouring plants, are more vigorous in growth, and produce earlier and heavier yields.

Under rotation extra trellises and more extensive cultivation are necessary. This additional expense is offset, however, by the advantages already mentioned. Under this system, too, the land can be periodically spelled from passion vine growing, and the trellises more easily repaired or replaced as required.

Whatever method is decided on, it must be borne in mind that to obtain the maximum profits from passion fruit growing provision must be made for the setting out of new vines at regular periods to replace the older ones as their production falls in quality and quantity. Experience suggests that a two-year system of replanting or rotation is the most satisfactory. This would necessitate the planting out of young vines during the spring of every second year.

A three-year rotation or replanting could be adopted, provided the vines remain healthy, vigorous, and productive. Practice has shown, however, that either rotation or replanting must be done at a shorter period than every four years if quality and quantity production of fruit is to be maintained.

HARVESTING AND PACKING.

Harvesting, packing, and marketing is quite as important as production, and every grower should aim at presenting to buyers well-matured, properly graded, attractively packed fruit. Enhanced prices received for well got-up fruit will justify the time and labour expended on its preparation for market.

Fruit should be gathered daily, preferably in the early morning or late evening, when the fruit is cool and is then not so likely to arrive on the market in a wrinkled or shrivelled condition. All dropped fruit should be picked up first, as a couple of hours in the hot sun is sufficient to cause severe scalding and, possibly, render the fruit unsuitable for packing.

Plate 177.
Top and lower wire system adopted on Russell Island.

The degree of maturity at which the fruit is picked from the vine is of vital importance, and judgment is required in order to obtain the right colour without the fruit being so far forward that it is likely to wrinkle. Good colour is very desirable, and during the cooler weather the fruit should be picked when it has assumed a deep purple. However, during hot weather fruit should be gathered when just a light purple shade has extended over half to three-quarters of the surface of the fruit.

When harvesting during wet weather allow the fruit to dry off thoroughly before being packed. All fruit should be carefully picked to prevent the skin being damaged. This is best achieved by grasping the fruit in the hand with the thumb and forefinger on the fruit stalk, then with a forward pressure of the thumb and a backward pressure of the forefinger, the fruit will be easily detached at a point where the fruit stalk joins the tendril just above the dead flower.

The picked fruit should be placed—not dropped—into the picking boxes or tins, which should be placed on the ground or slung on the body. These, when filled and until despatched, should be kept as cool as possible and sheltered from high winds.

Bordeaux spray can be removed by immersing the fruit in a weak solution of hydrochloric acid for one and a-half to two minutes, afterwards washing off with fresh water and being allowed to drain before packing.

Passion fruit forwarded to the fresh fruit market should be packed in half-bushel dump cases, and full instructions for packing the different grades are contained in an illustrated booklet which may be obtained on application to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Fruit intended for factory use need not be packed in cases, but may be forwarded to the canneries in sugar bags or similar containers.

DISEASES AND PESTS.

The passion vine does not usually suffer from any serious attack by insect pests. Spotting of the fruit results from the feeding activities of some minor sap-sucking insects, but little damage is done beyond a slight blemish of the outer skin. As the pulp is not affected the fruit is not harmed. Fruit flies have been known to attack the fruit in its green stage. The eggs, however, do not mature, but the skin surrounding the puncture becomes hard and detracts somewhat from the appearance of the matured fruit.

Fungus diseases such as brown spot and a virus disease known as woodiness or bullet, to which the passion vine is very susceptible, are the main causes for the premature failure in many vineyards. Powdery spot is a minor fungus disease which attacks the terminal growths and fruit during the cooler months of the year. Its attack is more serious on vines up to eighteen months old, since the proportion of the plant affected is then relatively greater.

Brown spot is the most troublesome disease affecting the vine. It attacks leaves, stem, runners, and fruit, causing considerable damage, and if neglected will result in the death of the vine within two years. Young vines are not so seriously attacked as older ones, as the more open growth admits light and air and permits most of the affected leaves to fall to the ground, carrying the fungal spores with them.

The recommended control for brown spot and powdery spot is to spray thoroughly with Bordeaux mixture of 4-4-40 strength. It must be remembered, however, that it is useless to spray a vine which has been allowed to become a tangled mass of runners and foliage. Correct pruning is a necessary practice in the control of these fungus diseases.

Woodiness is a serious virus disease, and growers are advised to exercise every care in an effort to prevent its spread. The following quotation from Simmonds summarises the precautions necessary for its control:—

> "Careful examinations of the plantation should be made towards the end of the winter, when woodiness will be showing up, and any plants exhibiting symptoms of this disease should be cut off at base so that the vine will have died and dried out before pruning time. Should a plant that has been missed be

> met when pruning, the knife and hands, if used on a diseased vine should be washed well in methylated spirits or soapy water before passing on to a healthy plant.''

J. H. Simmonds, M.Sc., Senior Plant Pathologist, has dealt with these diseases in a pamphlet, ''Passion Vine Diseases,'' copies of which may be obtained on application to the Department of Agriculture and Stock, Brisbane.

[CONCLUDED.]

The Orphan Tree.

Many failures are noted where replacements are made in a bearing deciduous fruit orchard. Frequently, the young tree remains like an unwanted orphan and shows only stunted growth. If it is to catch up to the other trees and fill in an unsightly and unprofitable blank space in the orchard, careful attention must be given to all details in its management.

The main causes of failure are:—

1. The lack of natural plant food for the young tree.

2. If the old replaced tree died from the attacks of some particular diseases, the replant may be attacked in turn and suffer an initial setback.

3. Searching roots of adjacent trees may compete successfully with those of the young tree for the available plant food.

4. Lack of attention.

When digging out the unhealthy tree carefully remove and burn all the roots together with the tree. Leave the hole open and exposed throughout the winter, and just prior to planting in spring fill with a load of virgin soil to which may be added some well rotted animal manure. Virgin soil is obviously richer in plant nutriants than soil which has been cropped exhaustively for some considerable time.

The young tree is very often forgotten and does not get the necessary attention at the right time. Weed growth may tend to choke it, but this difficulty can be simply overcome by the use of an old fertilizer bag. The bag is opened out and, after making a cut in the middle, is slipped over the young tree. This makes an excellent mulch which keeps down weed growth in the vicinity of the tree and conserves the moisture so necessary for its progress.

A. M. RICHARDSON, Inspector, Diseases in Plants.

The Sugar Banana.

The sugar banana has been a profitable proposition for many years past on all the ''bunch'' trade markets in Queensland. Small, sweet and delicately flavoured, this fruit claims many staunch supporters.

For the production of this banana deep, warm alluvial flats, favoured with a generous rainfall or watered by irrigation, are most suitable. As with other varieties good drainage is essential. As the sugar banana possesses a slender stem, damage by wind must be guarded against, and where there is no permanent wind-break it is worth while establishing one at the time of planting. For this purpose double border rows of lady fingers or sugar banana plants may be planted 7 feet apart in the row and 7 feet between the rows. The spacings in the inner row should actually lie between the spacings in the outside row, i.e., planted according to septuple system. These two rows close quickly in towards each other and rapidly form an effective wind-break. Of course, the planting of a permanent wind-break of suitable trees would be far more valuable on account of their permanency, provided the cultivated area is reconditioned from time to time.

Prior to planting, the soil should be worked to a depth of at least 12 inches and reduced to as fine a tilth as possible. The holes for the young plants in the plantation area should be 14 feet apart, 15 inches deep, and 18 inches square. The rows should be lined out as straight as possible each way, thus allowing the greatest convenience in working horse-drawn cultivating implements.

Opinions differ somewhat in the matter of selection of planting material, but generally a vigorous young sucker about 4 feet high dug from a matured stool is most favoured. The top portion of the sucker should be removed, leaving a plant of 3 feet in height to place in the hole. The plant is placed in position within the hole and sufficient surface soil placed in around it to fill approximately two-thirds of the actual cavity. The rest of the cavity is filled in gradually, as the ground is culivated during the ensuing year. According to the quality of the soil one or two followers are allowed to come away, and, normally, the first bunches will be harvested seventeen or eighteen months after planting.

Farmyard manure applied judiciously to sugar banana plantations will repay the grower handsomely. Light horse-drawn implements are satisfactory for cultivating, and green crops, such as Poona and field peas, are excellent soil invigorators, provided they can be turned back into the soil at the correct time, i.e., when still very soft and succulent.

As the sugar banana is usually marketed in the bunch and the fruit possesses a thin, delicate skin special care in handling is necessary in order to obtain the best market returns.

E. P. WILLIAMS, Fruit Branch.

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Water Blister in Pineapples.

Following on the recent rains numerous complaints have been made regarding the prevalence of water blister in pineapples arriving on the Southern markets.

Water blister infections occur only through freshly exposed tissue. Moreover, cuts, injuries, or skin cracks may become infected only so long as they remain moist. Consequently, water blister infections occur almost solely during picking and packing operations. In seasons of normal rainfall distribution infections take place chiefly through the cut or broken stem end, since—in fruit which has received careful handling—exposed tissue is to be found only at this point. Such infections are classed as ''stem end infections'' in contrast to ''side infections,'' which occur through breaks in the skin of the fruit caused by (*a*) careless handling or (*b*) climatic influences.

Stem end infections may be entirely prevented by strict adherence to the recommendations, which have been repeatedly given regarding plantation and packing-shed hygiene and the use of benzoic acid-kaolin powder. Growers are all doubtless familiar with these recommendations. However, side infections are more difficult to deal with. Apart from injuries resulting from careless handling, breaks in the skin of the fruit may occur in consequence of unfavourable climatic conditions during fruit development. A protracted period of dry weather while the fruit is developing results in it becoming ''skin bound'' as it approaches maturity. Should heavy rains occur at or about the time the fruit is ripening a rapid swelling of the tissues takes place, leading to the development of cracks and fissures in the tightly bound skin, particularly between the individual fruitlets or ''eyes.'' Such growth cracks provide ideal points of entry for the water blister fungus, and side infections of this type have probably been chiefly responsible for the recent heavy losses on interstate consignments.

Obviously, side infections cannot be controlled by the benzoic acid-kaolin treatment recommended for the prevention of stem end infections, but losses from sided infections may be greatly minimised if not entirely avoided if the following additional precautions are closely observed at times when stem cracks are likely to occur:—

(1) When packing for distant markets discard all fruit showing abrasions or recent growth cracks, the presence of which is usually indicated by exuding juices. Ordinarily, such fruits are quite suitable for cannery purposes if processed without delay, or they may be disposed of through any local outlet which will permit them to pass into consumption quickly.

(2) Avoid packing fruit while still wet from rain or dew, and use only packing material which is thoroughly dry.

(3) Practise strict sanitation, both in the field and in the packing-shed. Tops and damaged or diseased fruit should not be left to decay in the plantation or thrown into a heap near the packing-shed, but should either be buried or removed to low-lying waste land where they are not likely to prove a source of infection.

(4) Spray the benches, walls, and floor of the packing shed with 5 per cent. formalin solution at weekly intervals throughout the summer crop.

H. K. LEWCOCK, Pineapple Research Officer.

Papaw Renovations and Planting.

The tops of many papaw trees, which suffered severely from the dry conditions prevailing during last year, died back and the plants are now making lateral regrowth from the stem. Properly handled, they may still be profitably worked for another year or two. A large number of side shoots will have developed from buds low down on the trees. Three or four of these should be selected and allowed to form a nicely balanced tree. The unwanted shoots should be cleanly cut off close to the trunk with a sharp knife.

The dry withered tops should be cut back to a solid partition or node, and covered with tins to prevent the entry of moisture into the hollow trunk. Otherwise, core rots may develop and ultimately extend right down to the base of the trees.

Where young papaws are to be planted, ample organic matter should first be worked into the soil. This is particularly necessary in forest soils, which may have been previously under papaws or other fruits for some years. Good dressings of fertilizer are also desirable, and the following mixture can be applied per acre:—1 cwt. nitrate of soda; 2 cwt. bone dust or Nauru phosphate; 1 cwt. superphosphate; 1 cwt. sulphate of potash; or 1 to 2 lb. per tree.

Where young seedlings are being planted it is advisable to place two or three plants in the one hole. Any male or unwanted tree which may grow can then be dug out after the plants flower, leaving only one female plant to each hole. A distance of 8 feet by 8 feet should be left between the plants so that there will be ample room for good development.

Only shallow working implements should be used amongst papaws to destroy weeds and grass growth. Deep working may injure the root system, which will retard the growth of the tree and affect the production of fruit.

E. F. DUFFY, Instructor in Fruit Culture.

Woodiness in Passion Vines.

The disease known to growers as woodiness or bullet is probably the most important trouble in passion vines. As it assumes greater proportions during the cooler months of the year, passion fruit growers are recommended to keep a strict lookout for symptoms of this disease if they wish to keep infection down to a minimum.

Woodiness is due to the action of an ultra-microscopic virus present in the sap of the diseased plants. It affects the terminal shoots, leaves, and fruit. Many growers have great difficulty in detecting diseased vines, as the foliage symptoms are rather obscure, and oftentimes recognition comes only with malformation of the fruit.

The younger leaves on diseased vines are usually crinkled and puckered in contrast to the smoothness of the leaves on healthy vines.

On leaves produced in winter the lobes may be drawn out into narrow, elongated, irregular shapes, and on close examination a faint light-green mottling may be seen. Badly diseased vines have a stunted and unthrifty appearance; the fruits are lumpy and misshapen, with thick hard rind, small fruit cavity, and very little pulp.

It is possible to spread this disease from infected vines to healthy ones during pruning, harvesting, &c., by transferring the sap from one plant to another on the hands or pruning tools, unless adequate preventive measures are adopted.

An inspection of the vineyard should be made at regular intervals, and about one week before pruning is commenced each vine should be carefully gone over, and any vine suspected of being diseased should be cut off at ground level, or pulled out of the ground, care being taken not to disturb the aerial growth on the trellis. Then by the time pruning begins the diseased vines should be dry enough to remove without any risk of transferring the sap and so infecting neighbouring vines with which they may be entangled.

After handling a diseased vine and prior to commencing work on a healthy vine the hands, pruning tools, &c., should be freed from the virus by washing them in soapy water.

As an added precaution this act should be performed at all times when working among the vines, as soon as work on one vine has been finished and before proceeding to the next. This is advisable since, owing to the possibility of recent infection and the symptoms not being very pronounced, a diseased vine may escape the operator's notice.

The wild white passion flower is very subject to woodiness, and the symptoms are more easily recognised in this variety than in the purple passion fruit.

It has been noted that a large proportion of the wild plants are infected, thus forming a source from which the disease can spread to healthy vines in the vineyard probably per medium of the feeding activities of insects. Therefore the necessity for destroying all vines of this wild variety growing in the vicinity of the vineyard will be readily understood.

J. McG. WILLS, Fruit Branch.

IS BUTTON GRASS POISONOUS TO SHEEP?

Button grass is one of the best known and most widely spread grasses in Western Queensland. It comes away freely after the summer rains and soon dies off, but, like Flinders grass, is readily eaten by stock in the dried stage.

Recently this grass has come under suspicion as the cause of sheep-poisoning. The animals were yarded overnight preparatory to dagging. The sheep left untreated on the following day were then allowed the use of three small yards and a pocket with access to water. Early next day more than half were dead.

The stomach contents of two of the sheep were examined, and consisted almost entirely of leaves, stalks, and seed-heads of button grass. The sheep had fallen without any sign of struggle, most of them close to the water. The cause of death was uncertain, but it appeared that a large feed of fresh green button grass, plus a heavy drink of water, caused the sheep to bloat and die. They were, of course, quite empty when turned into the grazing yards.

A few years ago button grass was suspected of causing the loss of a number of rams untrucked after a train journey in the Richmond district. It has also been reported from Jundah that some sheep penned overnight in a yard that had not been used for many months, and in which there was a green and luxuriant growth of button grass, showed symptoms of poisoning next morning. Most of them recovered, but a few died.

Repeated tests of button grass for a prussic-acid-yielding glucoside have always given negative results, but in view of these records it would appear unwise to turn hungry sheep on to fresh button grass.

The symptoms do not, in all cases, point to bloat, and it must also be remembered that some grasses very closely allied to button grass are known definitely to be highly poisonous.

C. T. WHITE, Government Botanist.

The Fruit Market.

JAS. H. GREGORY, Instructor in Fruit Packing.

MARKET conditions during April were normal. Supplies of grapes and apples from Stanthorpe were considerably reduced. The quality of Granite Belt grapes this season has been excellent. Bananas have dropped off in quantity and quality, as a consequence of the dry weather during the period of development. At the present time consignments are not quite equal to demand so values should remain firm. Market prices for the month:—

TROPICAL FRUITS.

Bananas.

Brisbane.—Cavendish—Sixes, 8s. 6d. to 13s.; sevens, 8s. 6d. to 15s. 3d.; eights and nines, 11s. to 15s. Lady Fingers, 3d. to 8½d. doz.; Sugars, 4d. to 7d.

Melbourne.—Sixes, 13s. to 14s.; sevens, 15s. to 16s.; eights and nines, 17s. to 18s.

The first consignments of fruit packed in bushel cases were sent to Melbourne on 30th April.

Sydney.—Cavendish—Sixes, 14s. to 17s.; sevens, 17s. to 19s.; eights and nines, 19s. to 21s.

For the present the cluster pack is not advised for use. Information is being given to Southern retailers with a view to its future adoption.

Pineapples.

Brisbane.—Smoothleaf, 4s. 6d. to 9s. per case, 1s. to 6s. per dozen loose; Ripleys, 7s. to 9s. per case, 4s. to 7s. per dozen loose.

Melbourne.—10s. to 15s. per case. Green fruit unsaleable.

Sydney.—8s. to 15s. per case.

With cooler weather the fruit should be permitted to advance to a riper stage than in summer.

Papaws.

Brisbane.—Yarwun, 8s. to 10s. a tropical case; local, 4s. to 6s. a bushel case; Gunalda, 6s. 6d. to 7s. 6d. a bushel case.

Melbourne.—12s. to 18s. a tropical case.

Sydney.—10s. to 15s. a tropical case.

Avocados.

Supplies of this fruit were received on the Brisbane market from the North. The quality was excellent, but an improvement could be made in the packing. Growers are advised not to send consignments to arrive on holiday week-ends, for to clear the fruit greatly reduced prices have to be taken.

Brisbane.—5s. to 9s. a half-bushel case.

Sydney.—12s. to 14s. a half-bushel case.

Melbourne.—12s. to 15s. a half-bushel case.

Granadillas.

Some good quality fruit from Magnetic Island was inspected. This fruit was harvested slightly too soon. The best indication of maturity is when the flower end of the fruit changes slightly in colour. There is a good demand for good quality granadillas, prices up to 10s. per case for best quality fruit being realised.

Custard Apples.

Heavier supplies are now coming on the market, with a consequent easing of prices.

Brisbane.—2s. 6d. to 3s. 6d. a half-bushel case.

Sydney.—4s. 6d. to 5s. 6d. a half-bushel case.

Melbourne.—3s. to 5s. a half-bushel case.

Immature fruit is unsaleable on the Southern markets, as it turns black and hard in appearance.

CITRUS FRUITS.

The supply of oranges has been irregular, with prices unsteady. The poor primary crops, due to the drought, have no doubt been the cause of the irregularity.

Brisbane.—Commons—Gayndah, 11s. to 13s.; Howard, 8s. to 11s.; locals, 8s. to 10s. Navels—Gayndah, 11s. to 14s.; locals, 10s. to 12s.

Melbourne.—Queensland Navels, 10s. to 18s.

Sydney.—Local Valencias, 5s. to 10s. Mandarins.—*Brisbane.*—Glens—Gayndah, 15s. to 17s.; locals, 9s. to 11s. Fewtrells, 8s. to 9s.; Emperors, 8s. to 11s.; Scarlets, 9s. to 10s.

Melbourne.—12s. to 16s.

Sydney.—10s. to 12s.

Lemons.—Gayndah Specials, 13s. to 16s.; standards, 12s. to 13s.; locals, 8s. to 11s.

Sydney.—Lemons, 14s. to 16s.

Grape Fruit.

Brisbane.—7s. to 9s.

Sydney.—6s. to 10s.; cured to 15s.

Melbourne.—10s. to 14s.; a few specials higher.

Passion Fruit.

Brisbane.—First grade, 9s. to 10s., Specials to 10s. 6d.; second grade, 5s. to 7s.

Some nicely packed lines of this fruit are now on the market, and, as the prices show, are definitely reaping the benefit of the care taken.

DECIDUOUS FRUITS.

The grape season is now practically closed in so far as Stanthorpe is concerned. Experiments in obtaining a suitable packing filler for cold storing grapes have been successful. A sawdust has now been obtained which, after processing, is free from dust and taint and comparing favourably with cork.

Prices.—Waltham Cross, 6s. to 8s. per half-bushel case; Purple Cornichon, 7s. to 9s.; Muscatels, 3s. to 5s.; Ohanez, 5s. to 6s.

Apples.

Some excellent Granny Smiths and Jonathans have been seen on the market.

Prices.—Granny Smith, 7s. to 9s.; Jonathan, 6s. to 7s.; King David, 5s. to 7s.

Pears.

Excellent quality Winter Coles have been obtainable, ripening perfectly; other varieties show better quality than usual.

Prices.—Parkham's Triumph, 6s. to 8s.; Winter Nelis, 7s. to 8s.; Winter Cole, 7s. to 10s.

Persimmons.

Good quality fruit is saleable; small undersigned fruit is not wanted.

Prices.—5s. 6d. to 6s.

Tomatoes.

Good packing is still a great factor in effecting sales.

Prices.—Ripe, 3s. to 6s.; local green, 3s. to 6s. Stanthorpe and New South Wales, 7s. to 8s.; Specials higher.

Vegetables.

Beans, 5s. to 7s. a sugar bag; peas, 6s. to 9s. a sugar bag; lettuce, 6d. to 1s. a dozen. Greatly improved packing methods have added to the quality of lettuce now obtainable. A leaflet showing how the packing is done is obtainable, on request, from the Under Secretary, Department of Agriculture and Stock, Brisbane.

LEAF SCALD OF PINEAPPLES.

During the autumn, young pineapple plants frequently suffer considerable disfigurement from a conspicuous disease known as leaf scald. The disease derives its name from the fact that on drying out, affected tissues commonly take on a bleached or scalded appearance to produce large elongated whitish or straw-coloured spots which sometimes extend right across the leaves. The spots may be found in almost any pineapple field during the autumn months, and at times they become exceedingly numerous. They are usually most prevalent on vigorous young plants which have made rapid growth since planting. The disease is rarely found on hard-leaved stunted plants.

The spots vary considerably as regards size, shape, and colour. Many are large and white, and are noticeable from a long distance, while others may be small and inconspicuous. Typically the spots are characterised by an elongated straw-coloured central area surrounded by a dark margin. The typical light colour of the spots makes its appearance only on leaves that are exposed to sunlight. Spots developing in the shade are usually blotched or streaked with brown.

The parasitic agent responsible for leaf scald is probably the same fungus which causes soft rot (water blister) of pineapple fruits and base rot of newly-planted suckers or slips. It attacks the leaf-tissues through abrasions made by the sharp edges and serrated tips of neighbouring leaves. The extent to which the leaf tissues may be attacked and, consequently, the size of the spots which subsequently develop, is determined largely by weather conditions. Muggy, showery, or cloudy weather favours the development of the disease, while dry sunny conditions have the opposite effect. When plants are well shaded, whole leaves may sometimes be destroyed. The disease is purely a seasonal one, and rarely occurs after the middle of May.

Owing to the rapidity with which the spots may develop under favourable conditions, growers not infrequently become greatly alarmed by the occurrence of this disease in their young plantations. However, it should be remembered that the injury to any individual plant is comparatively slight, and does not warrant special measures for its prevention.

Except in the case of an exceptionally severe attack of leaf scald, it is unlikely that the vitality of affected plants will be appreciably impaired.

Some Fodders, Pasture and other Plants Reputedly Poisonous to Stock—Symptoms and Suggested Treatment.

CONSIDERABLE correspondence has in the past been handled by the Department of Agriculture and Stock relative to livestock poisoning due in many instances to the consumption of certain fodder plants and grasses which, whilst valuable as fodder, are, under certain conditions, apt to cause digestive and other troubles.

The droughty conditions which obtained during the 1936-37 period were responsible for increased attention to this subject, and numerous enquiries were made in connection therewith, whilst a request was received from a certain farmers' organisation that a publication be prepared for the use of farmers and stockowners in which a list of fodders and pasture plants known to possess certain deleterious characteristics, together with the antidotes and treatment suggested for such, be given. In this connection the combined services of the Veterinary, Chemical, Stock Foods, Botanical, and Agricultural Branches were enlisted, and the following information compiled for the benefit of all stockowners.

PLANTS CAUSING PRUSSIC ACID POISONING.

Perhaps the most important of the fodders likely to cause trouble to stock are those belonging to the sorghum family, which includes—

- Sudan grass
- Johnson grass
- Wild sorghum (*Sorghum verticilliflorum*)
- Saccharine sorghums—
  - Imphee or Planters' Friend
  - Saccaline
  - Orange cane
  - Amber cane
  - Early orange
  - Black sorghum
  - Honey sorgho
- Grain sorghums—
  - Kaffir corn (red and white)
  - Feterita
  - Milo
- Broom corn (broom millet)

and any other sorghum, all of which, irrespective of name, contain prussic-acid-yielding glucosides in their young stages. However, the amount diminishes with the degree of maturity of the plant. Whilst under normal climatic conditions a certain tolerance is enjoyed by stock, dry periods are frequently responsible for attention being drawn to the risks incurred by injudicious grazing management.

Although not now extensively grown, the old variety of sorghum known as Black Sorghum (*Sorghum nigrum*) was responsible for considerable trouble, but the risk of poisoning has been greatly reduced by the introduction of varieties such as Imphee or Planters' Friend, Amber Cane, Early Orange, and Saccaline.

The popularity that has been attained by Sudan grass is no doubt due to its many good qualities, including its suitability under normal conditions to grazing without any extensive troubles arising from the practice.

Under droughty conditions the performance of sorghums and Sudan grass is apt to become uncertain, and in cases where cattle have been grazing for a long period without ill-effects fatalities have occurred and have invariably been associated with plant immaturity and the presence of hydrocyanic acid (prussic acid) yielding glucosides.

The similarity of Sudan grass to Johnson grass is, in many instances, responsible for the inclusion of the latter in a crop of the former, resulting in more or less hybridisation and subsequent danger to stock if seed from such should be permitted to germinate and a crop therefrom subsequently eventuate. Johnson grass yields prussic acid to a much greater extent than Sudan grass and therefore is so much more dangerous. Due to the ease with which members of the sorghum family hybridise or cross-fertilise, the greatest of care should be exercised in the selection of seed, taking into consideration the possibility of such hybridisation.

Generally speaking, it is safe to say that members of the usually accepted fodder sorghums are quite suitable to feed once the plant has reached the flowering stage, but even under these conditions cattle should not be given access to a growing crop if in a starved or empty condition. Allowing the plants to wilt after cutting renders them safer to feed, and, further, prevents animals that are ravenous from eating too fast and too much—a frequent cause of trouble.

Broom Millet, also a member of the sorghum family, although not generally classed as a fodder, is sometimes utilised for grazing and is possessed of the same disabilities as other sorghums in regard to the danger of its indiscriminate use as fodder.

Johnson grass (*Sorghum halepense*) is a robust perennial grass three to five feet high, its chief characteristic being the possession of numerous well-developed white underground stems or runners. Pieces of these runners are capable of developing into fresh plants. The spikelets or seeds are barely a quarter of an inch long and are densely covered with silky hairs. The commercial seed, however, owing to the threshing process, does not carry these characteristics.

Wild Sorghum (*Sorghum verticilliflorum*) is common in Queensland and is probably more abundant than Johnson grass, with which it is often confused. It is a taller, more robust grass than Johnson grass, growing 6 to 8 feet high. The leaves and stems are often stained a purplish red. It does not produce runners as does Johnson grass. The spikelets or seeds are a quarter of an inch long and covered with silky hairs.

Several other common plants may be responsible for prussic acid poisoning of stock. The plants referred to are as follows:—

Frost-resistant Rhodes grass, winter-growing Rhodes grass, or evergreen Rhodes grass (*Chloris distichophylla*).—This grass, which is a native of South America, has been of recent years sold as a fodder grass. It is characterised by its heavy broad leaves and a large number of spikes in the seedhead. These latter number from forty to fifty, and the brown spikelets or seeds are covered with fine silky hairs.

Guinea grass (*Panicum maximum*).—Guinea grass, which is a native of tropical Africa, is now widely spread over eastern Queensland, and contains prussic-acid-yielding glucosides in small quantities, though no definite case of poisoning has been noted. It is a robust, tall grass with rather broad leaves and showy, wide-spreading seedheads. It is not cultivated to a great extent in Queensland, but is nevertheless fairly common.

Birdsfoot Trefoil (*Lotus corniculatus*).—This is a rather small legume with yellow flowers. It is characterised by having, in addition to the three leaflets of the ordinary clover, two extra leaflets at the base of the leaf stalk. The flowers, which resemble miniature pea flowers, are born in small heads at the end of a slender flower stalk. The flowers are followed by round pods an inch or so in length. This legume is occasionally sown in Queensland for grazing purposes.

SYMPTOMS AND TREATMENT.

The poisonous principle derived from the above mentioned plants is hydrocyanic acid (prussic acid). The symptoms and treatment of prussic acid poisoning are as follows:—

Acute Cases.

Prussic acid being such a rapidly fatal poison if taken in sufficiently large quantity, there are few or no visible symptoms to describe, but where sudden deaths occur for no apparent reason among healthy animals, prussic acid poisoning should be suspected. The post mortem examination of an animal immediately after death has occurred shows congestion of the lungs, fluid, black, and oily blood, the cavities of the heart contain bubbles of gas, and all parts of the corpse have a faint smell of bitter almonds. There may also be varying degrees of inflammation of the stomach and intestines.

Subacute Cases.

These cases occur when the animals concerned have not taken sufficient quantity of the plant to cause instant death. There is usually a period of excitement with great salivation, quick pulse and breathing, then the abdomen becomes enlarged due to the formation of gas in the paunch (in cattle) followed by diarrhoea. Later, convulsive spasms occur with dizziness and staggering and gradually paralysis, leading to loss of consciousness and death.

Treatment.

Keep the animal as quiet and warm as possible by covering with rugs in a dry stall, and, if possible, remove the poison from the stomach by passing the stomach tube. The best treatment, and for which the drugs should always be kept on hand, is the administration of a drench of ferrous hydrate which must be freshly made by mixing carbonate of soda (washing soda) and sulphate of iron. The mixture is made by dissolving one ounce of washing soda in one pint of water, dissolving half-an-ounce of sulphate of iron in a separate pint of water, and then mixing the two together. This quantity should be sufficient for a cow, and about half a pint for a sheep. If drenching cannot be done it is advisable to pour the mixture into the paunch of the cow through a canula, inserted as for bloat, a hand's breadth forward of the hip bone behind the last rib on the near side.

Sulphate of iron may be bought for about 3d. per lb., and washing soda for slightly less. A few pounds of each kept on hand for emergencies might obviate a serious loss.

Molasses, diluted sufficiently for drenching, has also been recommended by various people, a quart being considered sufficient for a cow.

PASPALUM ERGOT POISONING.

Following widespread outbreaks of ergot disease in the common paspalum grass in the 1935-36 and 1936-37 growing seasons, numerous cases of stock poisoning as a result of infected seedheads being eaten were experienced. The trouble is likely to recur in paspalum-growing districts in seasons favourable to the development of the fungus causing the disease in the seedheads. Paspalum is a densely tufted grass with broad green leaves and two to seven spikes of seed at the top of each seed stalk. The poisonous substance is present in the fungus on the seedheads.

Symptoms.

It will be noticed in dairy cows that milk production suddenly drops, and the affected animal loses condition rapidly, and though it will move about and graze to a certain extent, its movements are those of a sick beast reluctant to move. Some disturbance of the digestive system is present, usually impaction, but scouring may be seen. No marked fever with increase of temperature, pulse, and respiration is manifested.

Typical lesions are noticed on the muzzle and teats, which become red and sensitive, and gradually the skin of these parts becomes cracked and peels off, leaving a raw exposed surface. A discharge from the eyes and nose is usually present, and the animal may show varying degrees of lameness, from slight stiffness to staggering of hind limbs, with sometimes muscular twitchings and shivering.

Contrary to popular belief, abortion in cattle is uncommon in the disease as manifested in Queensland.

Treatment.

This must be applied in the early stage if loss of milk production is to be avoided. Drench at once with any purgative in order to get rid of the offending matter. A mixture which has been found useful is 1 lb. of Epsom salts and 1½ oz. of ginger dissolved in a quart of warm water. If recovery is slow a tonic should be given as:—

Ferri. Sulph. Exsic.	2 drachms.
Pulv. Nux. Vom.	1 drachm.
Mag. Sulph.	2 ounces.
Pulv. Gentian	2 drachms.

Give one powder night and morning in treacle for three days.

Vaseline or any soothing ointment should be applied to the sore teats.

To prevent the trouble, the affected grass should be mowed and burned where practicable, and arrange to graze on fodder crops during the dangerous stage (late summer and early autumn). Adopt any method of management which will prevent the animals from eating the affected pasture.

POISONING BY POTATO TOPS.

The feeding of tops of the English potato to stock often results in poisoning. The poisonous principles are the alkaloids solanine and solanidine.

Symptoms.

Gradual and progressive sleepiness followed by coma with eyes staring and glassy.

Treatment.

Keep the animal as warm as possible by covering the body with a rug and attempt to rouse the animal by douching the head with cold water, slapping, shouting, &c.

Give stimulants such as brandy, whisky, ammonia, and follow with a purgative.

PHOTOSENSITISATION CAUSED BY CLOVERS.

Various clovers may produce a condition known as photosensitisation. Probably the worst offender is the Burr Trefoil (*Medicago denticulata*) commonly known as Burr Clover, an annual plant very abundant in Queensland during late winter and spring. The leaves are borne in three's at the end of a common leaf stalk and are toothed at their margins. The flowers are yellow and borne in small heads at the end of a flower stalk. The small flowers are followed by twisted, spiral pods armed with numerous spines with a minute hook at the end. The burrs or pods cling to clothing, the hair of animals, &c.

Symptoms.

Intense irritation of exposed skin or nonpigmented skin, i.e., skin covered by white hair. Swelling of such areas accompanied by a watery exudation and sloughing of skin.

Treatment.

Place affected animals out of direct sun's rays. Cover susceptible parts of animal with a mixture of crude oil (waste engine oil) and blacking as a protection against the sun.

HOVEN OR BLOAT.

A number of fodder plants, particularly the clovers and lucerne, are capable of causing hoven or bloat of ruminants, when succulent green material is ingested in fairly large quantity.

Symptoms.

Great distress. Suppression of rumination. Acute abdominal swelling of a tense and drum-like nature, particularly between the last rib and thigh. Breathing accelerated and laboured. Nostrils distended. Eyes staring.

Treatment.

Mild cases.—Exercise, with massage and kneading of the left side. If animal can swallow give one ounce of turpentine oil in one pint of raw linseed oil.

Severe cases.—Release pressure by passing a trocar and canula into rumen (paunch). Position of entrance of trocar and canula is in triangle between last rib, backbone, and first part of pelvis. It is necessary to secure the animal firmly before operation. The oil drench, as given above, or a mixture containing either a teaspoonful of lysol or Condy's crystals in a quart of warm water, is then poured into the rumen through the canula after the trocar has been withdrawn.

◆

AUTUMN SPRAYING FOR CITRUS IN COSTAL AREAS.

Citrus growers in the coastal belt should now be making preparations for the autumn spraying against scale insects. Owing to adverse weather conditions little or no spraying was attempted in the spring. As a result infestation by scales in this region is more severe at present than would have been the case had the normal programme of scalicide application been carried out.

Pink wax scale is, of course, the dominant species. White wax is of importance in some orchards, while severe infestations of mussel scale have been observed on several occasions. As the lastnamed scale occurs on the fruit as well as on the leaves and woody parts of the tree its removal at this stage is particularly desirable.

The correct time for spray application is extremely important. Generally speaking, sprays should be directed against the young stages of the scales. The time will usually be determined by the behaviour of the dominant species, usually pink wax scale. With this insect sprays are best applied under normal conditions when the average young scale is about the size of a pin's head. Hatching is then reasonably complete, and further migration of young scales into the orchard from outside breeding sites is unlikely. Occasionally a protracted hatching occurs, and it may be necessary to delay spraying until a considerable number of the young scales are appreciably larger than a pin's head. Under no circumstances, however, should spraying be delayed until any significant percentage is twice that size.

If control operations are being directed against either of the two other species the time when the greatest number of young are present should be noted. Mussel scale breeds practically continuously and white wax scale has a rather protracted breeding period.

The resin-caustic-soda-fish oil spray is most useful at this time of the year. It is the only spray which gives satisfactory results against young pink wax scales appreciably larger than a pin's head or against well-grown mussel scale. Consequently it is the most efficient spray to use against pink wax scales when spraying has been delayed, either by protracted breeding or unsuitable weather conditions. It is also valuable when the control of both pink wax and mussel scales is required, as the optimum time for the control of these two species may not exactly coincide.

An oil-soap, soda spray may sometimes be used with advantage against pink wax scale associated with a light infestation of mussel scale. It is not as efficient as the resin-caustic-soda-fish oil against the latter scale, but it is much better than straight oil, which cannot be recommended unless young are present to the practical exclusion of other stages—a rather unlikely occurrence for this species. Of course, if pink wax is unaccompanied by any other species, and the hatching has been fairly even, soap-soda sprays alone may be used if applied at exactly the right time.

Excluding lemons, bearing trees which are carrying a considerable infestation of red scale will always be found to be in a poor state of health. They should receive cultural attention at once, for vigorously-growing trees do not normally suffer severely from the pest. If artificial control is necessary it should be established at this time of the year by the use of straight oil.

Are Our Seasons Changing?

N. J. KING.*

THE above question, frequently discussed amongst growers and others, influenced the writer to enquire into records for the Bundaberg area, with a view to finding an answer. Much of the credit for the large crops cut off the Woongarra and other soils in the early years of cane-farming is given to the favourable rainfall conditions then allegedly existing in the district.

It was found that rainfall figures from January, 1883, were available, and these are given in monthly precipitations from that date to December, 1935.

RAINFALL AT BUNDABERG POST OFFICE.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1883	752	461	126	128	307	0	29	109	30	352	24	191	2,509
1884	317	553	502	182	492	161	201	9	12	124	1,048	230	3,831
1885	237	288	343	46	194	595	4	38	515	48	119	490	2,917
1886	690	608	101	271	211	682	381	181	401	300	493	1,084	5,393
1887	706	1,152	1,336	674	42	29	527	512	440	64	611	371	6,464
1888	184	1,965	36	139	89	133	0	50	13	141	194	516	3,460
1889	77	224	783	891	398	58	757	247	179	76	545	561	4,796
1890	797	468	1,398	263	447	188	190	45	181	123	250	372	4,722
1891	774	72	249	389	367	1,331	152	297	126	217	311	795	5,080
1892	727	11	1,259	344	488	206	82	160	45	690	150	1,353	5,515
1893	2,270	3,210	965	223	207	1,479	186	420	52	89	156	31	9,288
1894	1,992	271	948	403	505	434	0	37	201	227	162	348	5,528
1895	2,280	731	79	459	150	1	204	10	304	174	265	1,106	5,770
1896	603	2,516	108	76	231	112	74	103	10	53	416	220	4,522
1897	547	343	392	30	248	174	792	51	333	464	111	588	4,073
1898	2,754	941	2,044	39	204	198	16	413	276	181	270	344	7,680
1899	1,131	726	376	413	292	142	233	262	167	160	6	762	4,670
1900	463	86	186	115	397	146	520	114	156	305	106	128	2,722
1901	234	261	317	1,027	114	74	201	559	180	218	128	0	3,313
1902	633	75	199	43	2	0	7	13	31	124	65	138	1,330
1903	97	260	605	38	1,155	33	598	88	355	43	325	997	4,594
1904	318	85	426	564	132	86	51	62	48	332	16	516	2,636
1905	1,667	217	335	631	426	110	71	17	95	237	95	674	4,575
1906	692	992	190	117	844	201	3	186	1,090	157	97	385	4,954
1907	329	390	1,281	38	308	449	87	43	0	170	290	299	3,684
1908	477	438	576	413	67	36	71	156	110	239	73	334	2,990
1909	652	370	506	154	67	151	565	166	98	41	355	299	3,424
1910	1,181	243	920	31	19	617	210	16	233	70	821	158	4,519
1911	2,105	975	431	246	56	0	37	115	0	236	130	298	4,629
1912	396	247	651	0	133	1,023	175	78	22	474	314	101	3,614
1913	4,575	429	673	501	531	345	126	2	152	18	183	522	8,057
1914	139	340	560	255	96	289	62	36	84	636	53	213	2,763
1915	386	1,281	7	44	182	58	103	131	28	80	108	312	2,720
1916	130	507	326	396	145	333	215	236	423	581	617	663	4,572
1917	907	846	1,071	199	184	4	22	114	354	239	648	302	4,888
1918	1,790	562	308	481	101	2	40	122	47	4	146	138	3,741
1919	16	322	537	153	655	13	0	48	0	228	63	5	2,038
1920	1,147	32	171	153	301	267	190	45	194	329	217	1,056	4,205
1921	741	72	338	881	204	448	288	885	35	80	168	1,614	4,954
1922	754	960	107	50	51	157	333	110	52	80	17	479	3,150
1923	822	48	48	660	0	410	90	80	180	34	134	378	2,884
1924	148	985	784	137	32	79	363	50	203	175	403	362	3,721
1925	1,366	596	570	56	59	792	45	102	57	61	129	645	4,478
1926	290	141	284	76	995	117	18	0	87	74	13	1,696	3,791
1927	2,580	530	926	383	18	326	106	122	100	301	528	584	6,604
1928	277	1,318	93	1,354	86	525	96	25	15	45	149	119	4,102
1929	421	1,073	249	725	31	336	4	39	18	239	238	624	3,997
1930	1,592	500	177	98	337	876	132	264	154	197	57	225	4,609
1931	279	2,377	691	134	439	117	64	90	83	147	349	944	5,714
1932	52	61	12	215	209	28	49	23	98	623	56	268	1,694
†1933	893	411	68	784	83	218	460	139	97	602	647	1,098	5,500
†1934	241	2,109	228	1,175	108	223	157	115	64	289	893	488	6,090
†1935	330	534	124	629	254	74	529	61	285	165	2	926	3,913

† Rainfall at Sugar Experiment Station.

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* In "The Cane Growers' Quarterly Bulletin" (Bureau of Sugar Experiment Stations).

In considering these records it is noticed that if the total annual rainfall be averaged for each five years from 1883 to 1932 the following figures are obtained:—

Period.	inches.	Period.	inches.
1883–1887	42.21	1908–1912	38.35
1888–1892	47.15	1913–1917	46.00
1893–1897	58.16	1918–1922	36.18
1898–1902	39.43	1923–1927	42.96
1903–1907	40.89	1928–1932	40.23

The 1893 to 1897 period is abnormal on account of the 1893 flood year, when the rainfall totalled 92·88 inches. Similarly, if we take each ten-year period and separate the very dry from the very wet years, we arrive at the following:—

Period.	No. of Years under 30 inches rain.	No. of Years over 60 inches rain.
1883–1892	2	1
1893–1902	2	2
1903–1912	2	0
1913–1922	3	1
1923–1932	2	1

It must be obvious from these authentic records that the seasons have not changed radically since 1883. Reference to the table will show that the monthly incidence of rainfall is also much the same now as fifty years ago.

We are frequently reminded of the large crops then harvested as compared with the present-day production. An endeavour was made to obtain figures of cane tonnage per acre for the earlier years, but lack of records defeated this effort, and comparison with present-day acreage returns is therefore not possible. Some records for the whole of the sugar-producing area of the State are, however, obtainable since 1900, and these are shown in the accompanying graph (Plate 178).

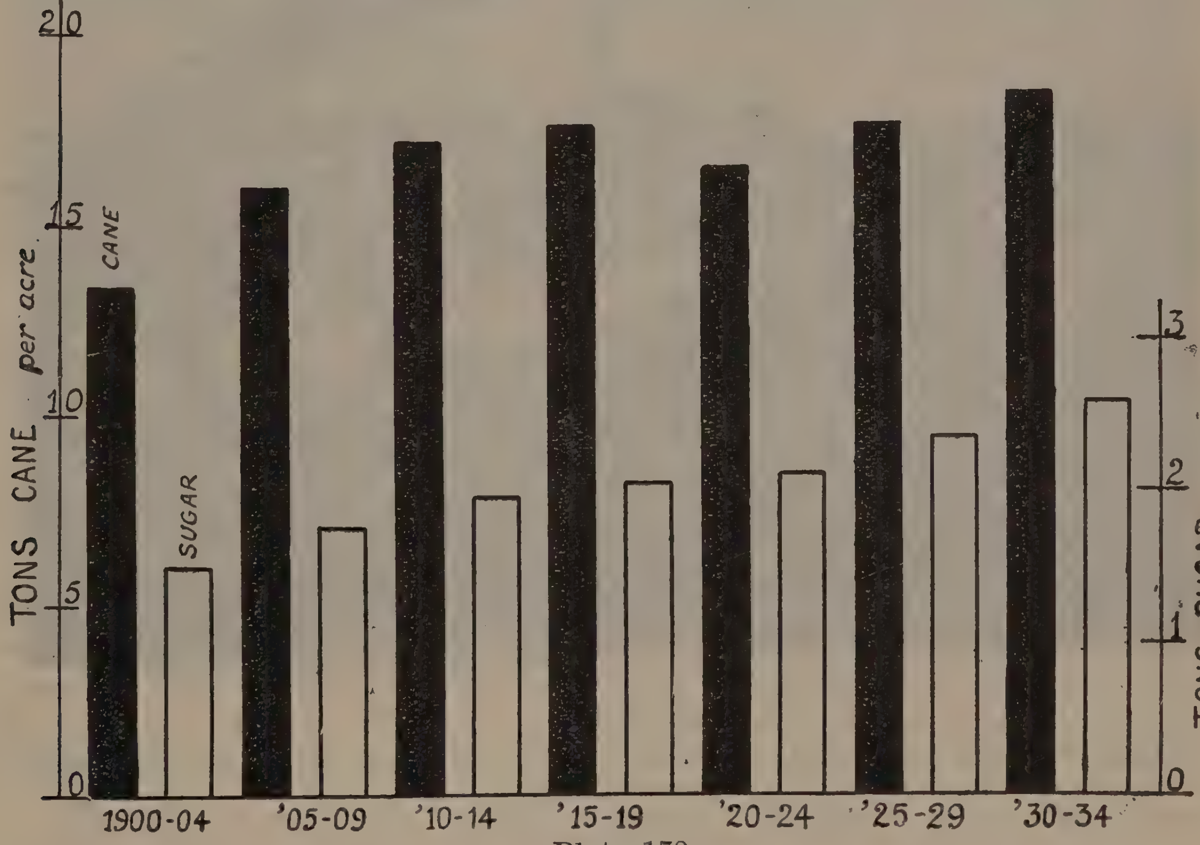

Plate 178.

Graph illustrating trends in cane and sugar production in Queensland.

This exhibits a definite upward trend of cane per acre since 1900. In seeking an explanation of the reputed large yields one can only conclude that during the first two or three years of cane-growing on new land occasional very large crops were harvested, but the reduction in crop returns must have been very marked after that period. Artificial fertilizers were not then used, and soil depletion would advance at a very rapid rate. What, then, was the reason for this decline in crop returns if seasons have not changed? It should not be forgotten that other major factors besides climatic ones were operating at that time. Firstly, the virgin nature of the soil with its ideal physical condition to a depth of many feet; secondly, the richness and fertility of that same soil after centuries of luxurious scrub growth, and the ultimate burning-off of the felled timber; thirdly, the natural subsoiling through the medium of the tree roots. The absence of implements in the early days kept the original soil under ideal conditions of tilth, and this condition existed for some years after farming began. It must also be remembered that mechanical planting was unknown as a farm practice, mechanical cultivation was not used, and the entire farm routine involved the use of far less implements than are utilized in recent times. All of these factors continued to keep the soil in a better state of tilth than exists at present; less soil packing then developed from implements, and plough and cultivation pans must have been virtually unknown.

Plate 179.

DELIVERING DAIRY CATTLE BY AIR TRANSPORT, AUSTRALIAN MANDATED TERRITORY, NEW GUINEA.

Irrigation Waters of the Burdekin Delta.

N. G. CASSIDY.

THE underground water of the Burdekin delta is a subject of everyday interest, as well as of vital importance, to cane growers of the area. Many strange statements are made regarding the underlying drifts, and queer theories are often held as to the replenishment of them. Growers will, therefore, appreciate a short account of what is definitely known about the water-bearing beds and what conclusions can reasonably be drawn from a knowledge of the facts.

The gravel or sand ''drifts'' in which the water occurs cannot be mapped out in any simple way on account of the variety of conditions existing. At one particular spot a band of clay may separate streams which are shown by analysis to be quite unlike each other, and, contrary to expectation, the top supply may be more salty than the lower one. However, on proceeding from district to district, certain tendencies are evident, and it is possible to divide the area into three zones. The inland districts of Airedale, Maidavale, Pioneer, Dick's Bank, Klondyke, as well as most of Home Hill, comprise the first zone. The waters obtained under these districts have a ''family'' resemblance to one another, and are similar in composition to the flood waters of the Burdekin River. The second zone of the Delta is made up of the coastal districts, Seaforth, Rita Island, and lower Home Hill. Here the mineral content of the waters is much greater, and it is similar in type to that of sea water. The third zone is made up by the intermediary districts, McDesme, Ivanhoe, Kalamia, where the waters encountered have their own peculiarity of a high content of free alkali. The second and third zones thus yield less suitable irrigation waters than the first.

The evidence concerning the distribution of waters of different types gives a clue to the origin of the whole supply. It suggests that, in the main, replenishment of the supply takes place by flood waters moving along old river channels which have been covered up but are still very pervious to water. In the intermediate zone some obstruction to free flow of water occurs, and the water takes up considerable amounts of mineral matter. In the coastal districts sea-water penetrates the drifts in places, the connection between the two bodies of water being clear from the rise and fall of level which take place with the tides.

These conclusions are well supported by evidence of the rise in level of bores, subsequent to flooding in the river. The immediate response in the first zone of the area is contrasted with the lesser sensitiveness of bores situated elsewhere. Since neither the extent nor the time of the rise in level after rain is uniform, it follows that direct penetration of rainfall is not responsible for the renewal of underground supplies, particularly when the quality of the water is found to vary from district to district. It should be pointed out that the underground supplies could not possibly be derived from the sea, as the brine could not be removed by any natural process of filtration. Everything indicates that river flooding is the principal source of replenishment and, moreover, the evidence available does not point to any permanent depletion of the supply.

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* In the current ''Cane Growers' Quarterly.'' Reprinted by courtesy of the Director, Bureau of Sugar Experiment Stations.

It is of interest to compare the quality of Burdekin waters with that of rivers and irrigation waters in other parts of the world. Such a comparison shows that Burdekin waters in general have an unfavourably low ratio of "hardness" to "salt." In other words the mineral matter of the waters contains too small a proportion of calcium, or "lime." This may cause grave damage in extreme cases, especially when regular waterlogging of the soil is allowed to take place. Recent investigations show that even when the chemical action of salty water on the soil has only proceeded to 30 per cent. of the maximum extent possible, the soil has already suffered the maximum damage to its physical condition that it can undergo. All this illustrates the need for care in the use of the right kind and amount of irrigation water. A bad supply may possibly be improved by sinking deeper, or by lifting the spears. At all times of doubt a sample may be sent to the Bureau for analysis and for comparison with any previous tests. Except near the sea-coast any particular bore generally yields water of very constant quality from year to year.

For a fuller discussion of this subject growers may obtain, free, on application to the Bureau of Sugar Experiment Stations, Department of Agriculture and Stock, Brisbane, the original article published as Technical Communication No. 1 (1937).

LETTUCE-GROWING.

Lettuce is one of the most popular vegetables, and with regular sowing and care in cultivation it may be grown the whole year round. In Queensland the best times for planting are the late summer, autumn, and winter.

Lettuce is a vegetable that must be grown quickly to ensure crisp leaves. If a check is received during growth the leaves acquire a slightly bitter taste, which tends to decrease the market value of the plants. This defect is more prevalent during the late spring, early summer, and autumn plantings.

The soil must be well cultivated, and it is desirable that where possible large quantities of well-rotted farmyard manure be incorporated with the soil. Should fresh manure be used some time should elapse before planting.

Lettuce may be grown in a seed-bed and transplanted into rows, allowing 12 inches between the plants. The seed may also be sown directly into the row and the plants later thinned out to the required distance.

Sow the seed thinly and cover lightly with fine soil, and then firm the ground gently.

During the growing period the soil around the plants must be kept cultivated, but care must be taken not to allow any soil to get on or into the hearts of the plants. Constant watering is essential and the soil should never be allowed to dry out. Should the plants appear to be growing slowly an application of liquid manure would be beneficial, or, failing this, a top dressing of nitrate of soda or sulphate of ammonia at the rate of 1 to 2 cwt. per acre. These fertilizers should be spread lightly over the ground, but under no circumstances on the plants.

Lettuce should be marketed as soon as possible after cutting, as they deteriorate in quality very quickly.

The cabbage type of lettuce is the popular one in Queensland, and should be cut for market as soon as possible after hearting. For home use they may be used earlier.

Popular varieties for planting are:—

New York or Neapolitan.—A very large variety, best suited for planting in the cooler months.

Iceberg.—A large, good-hearting variety, with crinkled leaves and pink tips, suitable for summer planting.

A pamphlet on packing of lettuce for market is obtainable free on application to the Department of Agriculture and Stock.

The Tropics and Man

Radiation.

DOUGLAS H. K. LEE, M.Sc., M.B., B.S., D.T.M., Professor of Physiology, University of Queensland.

No. 5.

MEDICAL knowledge, just as any other branch of learning, has had to undergo a very gradual and painful development from the humblest beginnings. Many conditions which appear fairly well understood to-day were quite imperfectly understood a few years ago. This process of development is going on still at what appears to be an ever-increasing rate. There is this possible difference, however, that to-day man will admit a little more readily than he used to do, that he does not know or understand something. It is a natural impulse to conceal ignorance, and medical minds are just as human as others. A number of the effects of tropical residence were, until recent years, not properly understood, and were ascribed to such mysterious and mythical agencies as miasmata, lack of air, and so on. Many of these have been stripped of their camouflage and intrepid investigators deal with the most intimate details in the private lives of the malaria protozoon, the Weil's disease spirochaete, and the typhoid bacillus. The "debunking" of other mysterious influences, such as that of the radiations, and particularly the sun's radiations, is of more recent occurrence still, and so well ingrained are the old ideas that a hankering after the old superstitions is still widely manifest. Nevertheless, there is nothing mysterious about these radiations, and they can be dissected and classified with greater ease than the more popularly recognised organisms.

Radiations at Home.

The first family of radiations is that of the *wireless waves*. As far as we know, they have no effect upon the human body (until transformed into crooning or speeches), which is just as well in this wireless era.

The next family is a very extensive one, often divided into three parts for convenience, although one would be hard put to it to say where one part begins and another ends. The longest chaps in this family are the *heat or infra-red rays*. When they fall upon the human eye they do not excite it to vision, but they do affect a photographic plate, a fact which has recently revolutionised aerial photography. When they fall upon the body they are absorbed and give rise to increased temperature of the part they fall upon. (A glowing fire of red coals often heats more than a blazing fire.)

The medium-sized chaps are the *light waves*. They also affect a photographic plate, but more rapidly than the heat waves. They too tend to raise the body temperature, but not nearly so much. The light waves, particularly the shortest ones, have another property, that of burning the skin. Their outstanding property, of course, is that of exciting the eye and producing the sensation of sight.

The smallest chaps in this family are the *ultra-violet waves.* Their chief properties are those of affecting photographic plates, and of burning the skin. They are not visible and give rise to very little heat in the body. They are somewhat peculiar amongst radiation in being able to penetrate only the tiniest way into the skin, but in this distance they can do a lot of damage, as anyone with bad sunburn will testify.

The third family of radiation is that of *X-rays and radium rays.* These are very short, but penetrate the body very well, affect photographic plates and produce burning in the part of the body upon which they fall.

The last family is that of the *cosmic rays.* About these we know very little, but so badly did Professor Picard want to know more about them, that he engineered the first strato-sphere balloon ascent—truly an epic adventure—to measure and investigate them before they got lost in the world's atmosphere.

Radiation in the Tropics.

Introductions have now been effected, and, as is usually the case with introductions, you are probably very little the wiser. However, you are spared the embarrassment of asking them their names, since you can look back surreptitiously now and then, to refresh your memory. You have met them at home; now see them at work.

The first family of wireless waves and the third family of X-rays we can ignore since they are artificial and not specially active in the tropics. The last family of cosmic rays may turn out to be of importance, but they are so aloof, that, in spite of their mysterious and intriguing character, we cannot say anything very definite about their incidence or possible effect in the tropics. There is, so far, nothing to indicate that they have any special effect in the tropics.

The important family is, therefore, that large and complex second one. There is no doubt that the total amount of this radiation received in the tropics is greater than that occurring in greater latitudes. We need nothing to tell us that the heat is greater, and one is quite prepared to believe that the light is more intense. It is popularly supposed, and I for one believed it until shown otherwise, that the ultra-violet radiations in the tropics are much more intense. No wide survey has been made of ultra-violet light in the tropics, but some very careful estimations made on the African coast have shown that the ultra-violet radiation there is no greater than that in the German countryside. Why this is so is not fully understood, but it is generally accepted that the high humidity of the atmosphere absorbs these radiations as they pass through it on their way from the sun to the earth. On a clear day in the hot desert, ultra-violet radiation is almost certainly high, but on a dusty day, the greater proportion of it is absorbed by the dust in the air.

Effects of Tropical Radiation.

A dear lady once solemnly assured me that the sun on the southern side of Port Said was very different, and in some mysterious way much more malignant than on the north side of Port Said—a matter of a hundred miles at the most. Some fifteen years ago in Malaya, it was the custom for children to be kept indoors until three or four in the afternoon with windows shuttered *and topees on,* as though some solar hobgoblin were darting about seeking some forgotten and tortuous path of attack. (That is completely altered now, with great benefit to the children.)

It seems reasonably clear that there is nothing mysterious about tropical radiations. They are the same radiations as occur in temperate countries, but some of them are more intense. The effects of this increased intensity of radiations are as follows:—

1. Sunburn readily occurs through the agency of the light and ultra-violet rays. Wind, rain, and blowing sand materially aggravate the effects of sunburn.

2. There seems to be a definite tendency to more frequent occurrence of rodent ulcers and skin cancers on the exposed parts, particularly in the fair-skinned type of person who does not go brown. Chronic irritation of any description is a well-known cause of cancer, and it is highly probable that the constant irritation of sunburn in these people acts as the stimulus.

3. A condition known as ''glare asthenopia'' is very common, and again, is said to be commoner in blue-eyed persons. There is tenderness of the eyes, inability to stand any kind of a glare, and frequent intense headaches.

4. Cataract is rather common in the tropics, but diet probably plays an important part there.

5. ''Heat effects.'' These are the most important effects. They include heat exhaustion, heat hyperpyrexia, and heat cramps. They are all due to interference with the necessary loss of heat from the body as described in earlier articles. Heat radiations may participate directly in this interference or light rays may join in by giving rise to heat when absorbed by the skin. The actual part exposed to these radiations may be a little hotter than the rest of the body, but usually the heat created locally by these radiations is quickly carried all over the body and helps to raise the general body temperature.

You will notice that I have said nothing about ''sun-stroke.'' This was the name given to all sorts of sudden collapse occurring in people who happened to be exposed to the sun at or about the time of the collapse. It was supposed to be due to a mysterious effect of the sunlight falling upon the head and neck. We now know that the causes of these cases of collapse were very varied—malaria, alcoholism, heat exhaustion, hyperpyrexia, &c., and such cases can occur just as readily in hot mines, where no sunlight exists. Sun-stroke is no longer a suitable medical term. As a matter of fact, the most intense sunlight falling on the head and neck will produce very little, if any, rise in temperature of the brain above that of the body in general, which was the supposed mechanism at work. In a later article I hope to deal a little more fully with these effects of heat. Next time I propose to run over some of the other atmospheric conditions which may have an effect upon man or have been blamed for certain effects at different times.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society and Jersey Cattle Society, production charts for which were compiled during the month of March, 1937 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter. Fat.	Sire.
		Lb.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORNS.			
	Mature Cow (over 5 Years), Standard 350 Lb.			
Morden Pansy 2nd	R. Mears, Morden Farm, Toogoolawah	9,585·25	411·918	George of Nestles
	Junior, 4 Years (under 4½ Years), Standard 310 Lb.			
Fairy Bower Shamrock	E. O. Jeynes, Raceview	12,455·06	511·781	Blacklands Peer
	Senior, 3 Years (over 3½ Years), Standard 290 Lb.			
Mabreen Heartease II.	F. G. Haldane, Wolvi, Gympie	8,771·25	333·994	Springdale Surprise
Mabreen Princess	F. G. Haldane, Wolvi, Gympie	8,731·6	313·098	Numbawarra Headlight
	Senior, 2 Years (over 2½ Years), Standard 250 Lb.			
Sunnyview Thelma (365 days)	J. Phillips, Sunnyview, Wondai	16,411·45	702·2	Lovely's Commodore of Burradale
College Stately 4th	Queensland Agricultural High School and College, Gatton	10,420·78	407·643	College Robin
Morden Nora 14th	R. Mears, Morden Farm, Toogoolawah	9,172·00	373·45	Jupiter of Morden
College Stately 6th	Queensland Agricultural High School and College, Gatton	8,320·08	352·308	College Robin
Rocklyn Colleen	T. A. Strain, Wondai	8,090·95	305·662	Oakvilla Champion's Prince
	Junior, 2 Years (under 2½ Years), Standard 230 Lb.			
Rocklyn Connie	T. A. Strain, Wondai	6,257·95	260·833	Kurrajong Reddie's Beau
	JERSEY.			
	Junior, 2 Years (under 2½ Years), Standard 230 Lb.			
Oxford Best's Dolly	S. H. Caldwell, Walker's Creek, *via* Bell	5,205·91	266·055	Oxford Best
Wyreen Cress	J. B. Keys, Gowrie Little Plain	5,595·86	371·497	Lyndhurst Majesty

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.

Wild Millet.

W.L.S. (Komine, Q.)—

The specimen represents the wild millet, *Echinochloa crusgalli*, a fairly common grass in most warm-temperate countries. It is represented in Queensland by a number of forms. The one you send occurs mostly as a weed of cultivation or growing in damp places, rather than in the ordinary pasture. It is very closely allied to such well-known cultivated fodders as Japanese millet and white panicum. Seed is not stocked by nurserymen, but where it grows Japanese millet can be grown for the same purpose, namely green feed for dairy cattle.

Water Weeds in Reservoirs.

K.M.C. (Winton)—

Most of the weeds in earthern tanks are algae and the drying and scraping of the sides would have no effect on these. The usual method of ridding tanks of submerged water weeds is using copper sulphate, which may be put into a coarse sack and dragged backwards and forwards from the bank until it it is all dissolved.

To be safe for drinking purposes the copper sulphate must not exceed one part in a million parts of water by weight, that is, 1 lb. to every 100,000 gallons of water. You probably know the contents of your tank and so could calculate the quantity of copper sulphate required. As it is a poison, of course it must not be made too strong. The usual practice is to make an application and then a second in about a fortnight's time.

Water Couch.

E.G.T. (Dawson Valley)—

Your specimen represents the water couch, *Paspalum distichum*, a very common grass in Queensland, and, away from the coast, generally found in melonhole country, or along the banks of creeks and in similar wet situations. In such situations it is a very valuable grass, has a high fodder value, and is much relished by stock. It is a native grass, but is widely spread over most warm temperate and sub-tropical countries. It is easily spread by roots and is probably introduced into fresh localities by water fowl.

"Mackie's Pest."

L.B.S.R. (Mirriwinni, via Babinda)—

The grass is *Chrysopogon aciculatus*, a grass widely spread over the tropical regions of the world, and known in North Queensland as grass seed, or Mackie's pest. The seeds are apt to produce irritating sores, which may last for months.

We think the only way of dealing with the grass would be to plant the school play-ground with some grass of a more smothering nature, and would try any of the following:—

(1) Kikuyu.

(2) Para grass, or giant couch. This is often known in North Queensland as *Panicum muticum*.

(3) Buffalo grass.

All these grasses are grown from cuttings, and the land would have to be dug over, before planting, as they do best in ground that has been worked. Roots of all three should be obtainable at Cairns.

Wild Sorghum.

J.B.A. (Radford)—

The grass is *Sorghum verticilliflorum,* commonly known as wild sorghum, a native of South Africa now very common as a naturalised weed in Queensland, particularly along roadsides, railway embankments, or, in fact, anywhere where the ground has been disturbed. As you know, most of the sorghums possess a prussic-acid yielding glucoside and must be regarded as dangerous. The present species is one of the worst in this respect, and if fed to stock caution should be observed in not letting them gorge themselves on it on an empty stomach, and preferably the grass should be cut and allowed to wilt before being fed to stock.

Plants from the Mid-west Identified.

A.C.McA. (Drillham)—

1. *Dichanthium sericeum,* blue grass; one of the best of the native grasses.
2. *Cyperus fulvus,* a sedge, not a true grass.
3. *Panicum Buncei,* a native panic grass. Most of the native panic grasses are very useful in the average mixed native pasture.
4. *Sporobolus Berteroanus,* Parramatta grass or rat's tail grass, generally regarded as a grass of very poor quality.
5. *Brachiaria piligera,* an excellent pasture and hay grass. Although a native grass generally seen in old cultivation lands, or in places where the ground has been broken, rather than in the ordinary pasture.
6. Seed heads required for determination.
7. *Aristida leptopoda,* a 3-pronged spear grass. On the whole, 3-pronged spear grasses are of poor quality, but this is the best of the species, and makes a fair amount of bottom feed suitable for sheep.
8. *Sporobolus pallidus,* sometimes called fairy grass. A very short-lived grass during the summer months; probably useful in the mixed native pasture, but not of any particular merit.
9. *Eragrostis cilianensis,* stink grass. This grass mostly occurs as a weed of cultivation, although in some places it has run out into the ordinary pasture. Generally speaking it is not touched by stock, although we have heard that stock will sometimes eat it in the form of hay.
10. *Tragus racemosus,* small burr grass.
11. *Aristida personata,* a wire grass or 3-pronged spear grass.
12. *Dactyloctenium radulans,* button grass. A short-lived summer grass, but an excellent fodder both for sheep and cattle, very much relished both in the green stage and when dried.
13. *Cyperus gracilis,* a sedge, not a true grass.
14. Looks like *Digitaria marginata,* ordinary summer grass, but seed heads are required to be certain.

In reply to your query as to how to keep your collection, grasses look very well if pressed flat between sheets of newspaper for some little time and then mounted with gum strips on to thick paper or thin cardboard. The name should be attached and a few notes on the properties of the grass, where collected and the date. If you prefer it, the grasses could be made up into small sheaves and tie-on labels attached.

Vigna lanceolata.

A.C.G. (Cambooya)—

The specimen represents *Vigna lanceolata,* a native plant for which we have not heard a common name. It belongs to the same genus as cultivated cowpea, and is generally regarded as an excellent fodder. It becomes rather a pest in cultivation, owing to its habit of rooting very deeply, and parts of its underground system, when broken, being capable of sending out new shoots and forming new plants. No really satisfactory method of getting rid of it in cultivation, other than keeping the green growth down, is known.

French Millet.

W.E.J. (Mundubbera)—

The specimen is French millet, *Panicum miliaceum*. This grass is not known to be poisonous or harmful at any stage of its growth, although it has gone out of favour of recent years as a green food, as compared with other millets such as Japanese millet and white panicum. The seed of French millet is a common ingredient of mixed birdseed.

Lawn Grasses and Hedge Plants in Western Queensland.

A.F.H. (Longreach)—

Buffalo Grass (*Stnotaphium secundatum*). On the whole, experience has shown this to be perhaps the best all-round lawn grass for Western Queensland. It is rather hard grass to cut, and must be kept fairly short, but seems to stand the western conditions much better than other lawn grasses.

Couch Grass (*Cynodon dactylon*). There are some quite good lawns of this grass in Western Queensland, and in most western towns where there is a bowling green, the sward is composed of this grass.

Blue Couch (*Digitaria didactyla*). We do not remember seeing any lawns of this grass in the West, and are inclined to think it would be rather soft for the purpose, unless water is plentiful.

Roots of the three grasses may be obtained through any nursery channel.

Blue couch and buffalo grass are grown from roots only, but the common couch is sometimes grown from seed.

Water or Swamp Couch (*Paspalum distichum*). We have had no experience with this grass as a lawn grass. It is a great pest in cultivation, and has overrun some of the cultivation paddocks at the Farm School, St. Lucia, near Brisbane.

Regarding plants for hedge-making, here are some suggestions:—

Vitex trifolia variegata. We have seen some splendid hedges of this in the far West.

Common Olive (*Olea Europeae*). The common olive is sometimes used as a hedge in the southern States, but we do not remember seeing any hedge of it in Queensland, although we have seen a very beautiful avenue of it. We should think the objection to it would be that it would be rather slow growing.

Cypress Pine. Horizontal *Cyperus, Cupressus lambertiana horizontalis*, is the best of all the cypresses for making hedges. We think it would do quite well at Longreach, but do not remember seeing any hedges of it, or individual trees in the Central West.

Oleander. The oleanders make quite suitable plants for hedges, but it is sometimes difficult to get them leafy right to the base. As you know, they can be had in various colours. There is one rather showy species with a variegated leaf.

Hibiscus. These shrubs make quite good hedges, but it is sometimes difficult to get them leafy right down to the base.

Tecoma capensis. This makes quite a good hedge, particularly for a high hedge, say 8 to 10 feet, in which case it flowers profusely. When in bloom, with its red, tubular flowers, it is rather a showy sight.

Guinea Grass. Blue Panic.

R.C. (Mundubbera)—

1. *Panicum mamimum*, Guinea grass. This grass occurs in several forms in Queensland. The one sent by you has been distributed under the name of green panic, or green panicum, and this particular form is an excellent grass, without the coarse, hard stems, commonly developed by the ordinary type of Guinea grass. It is well worth growing for fodder, but is only suitable for cultivated areas. A small paddock of it would be, however, an excellent stand-by to any dairyman.

2. *Panicum antidotale*, blue panic. This grass has been widely advertised as a fodder. It is fairly drought-resistant, but is more a grass for growing in small cultivation paddocks rather than in the ordinary pasture. As such, it would be an excellent stand-by. The stems are rather caney, but they have the habit of sending out tufts here and there along their length, and these tufts provide a good bulk of leaf foliage for stock, particularly cattle.

General Notes

Staff Changes and Appointments.

The following transfers of inspectors of stock, slaughterhouses, and dairies in the Department of Agriculture and Stock have been approved:—Messrs. R. J. O'Sullivan from Allora to Killarney, J. Cattanach from Beaudesert to Allora, and P. McCallum from Brisbane to Gladstone.

Mr. J. P. Lee, Court House, Mossman, has been appointed Chairman of the Mossman Local Sugar Cane Prices Board—vice Mr. T. W. Foran, transferred—and also an Agent of the Central Sugar Cane Prices Board for the purpose of making enquiries under Section 5 (2A) of the Regulation of Sugar Cane Prices Acts in regard to sales and leases of assigned lands.

Constable D. C. McQuaker, Proserpine, has been appointed also an inspector under the Brands Acts.

Mr. C. E. Ellis, District Inspector of Stock, Warwick, has been appointed also District Inspector of Brands.

Mr. K. D. Hoffmann, Inspector, Diseases in Plants Acts, and Banana Agent, has been transferred from Nambour to Dayboro'.

Mr. C. E. Scott, Brookfield, Yeulba, has been appointed Acting Inspector of Stock at The Canal Dip, Yeulba.

Mr. G. Johnson, Mia Mia, via Mirani, has been appointed millowners' representative on the North Eton Local Sugar Cane Prices Board, vice Mr. S. H. Scougall, resigned.

Mr. R. L. Hunter, Freshwater, Cairns, has been appointed an honorary ranger under the Animals and Birds Acts and the Native Plants Protection Act.

Mr. A. E. Beak, manager of Salisbury Plains Station, Bowen, has been appointed an Honorary Ranger under the Animals and Birds Acts.

Arrowroot Board.

Nominations in connection with the election of five growers' representatives on the Arrowroot Board have been received at the Department of Agriculture and Stock from Messrs. Robert Stewart, Ormeau; Carl Brumm, Woolgoolba; Alexander Rose, Norwell; George R. Walker, Upper Coomera; and Leslie R. Oxenford, Oxenford.

The first four mentioned persons are at present members of the Board, Mr. J. F. Cassidy, the other member, did not renominate for this election. The new Board will be appointed for a further term of three years.

Animals and Birds Sanctuary at Coalstoun Lakes.

The National Park Reserve R. 94, Coalstoun Lakes, via Biggenden, has been declared a sanctuary under the Animals and Birds Acts, and it will be an offence to take or kill any animal or bird in this Reserve. Messrs. R. W. Martin and H. G. Bundock, of Coalstoun Lakes, have been appointed honorary rangers in connection with the sanctuary.

Grade Standards for Cavendish Bananas.

An amending regulation has been approved under "*The Fruit and Vegetables Acts,* 1927 *to* 1935," providing for an alteration in the "Standard" grade of the new grades "Standard" and "Large" for Cavendish bananas which were approved last month. The minimum length for "Standard" grade Cavendish bananas shall be six inches instead of six and one-half inches.

Sugar Levy Regulation.

A regulation passed in March under the Primary Producers' Organisation and Marketing Acts empowered the Queensland Cane Growers' Council to make a particular levy at the rate of one-halfpenny per ton of sugar-cane harvested during the coming season, such to be expended on matters of an economic, legal, or compensatory nature where such matters are of vital importance to the sugar industry.

The time for the receipt of a petition for a poll on the question of whether or not the levy should be made was set down as the 19th April, but an amending regulation extends the date for the receipt of such a petition until the 17th May, 1937.

Rural Topics

Border Line Cream.

Every factory manager must formulate a policy in regard to the lowest quality cream that can be manufactured into choice quality butter at his particular factory. Modern methods of manufacture and factory equipment have done much to enable the utilisation of cream which a few years ago would have been discarded. Nevertheless, the dairying industry still offers no exception to the general rule—that the quality of raw materials directly influences the character of the manufactured product. The addition of a few faulty cans of cream to a vat may thus cause the spoilage of otherwise choice quality butter. Only a thorough knowledge of the origin and nature of a given defect can help in determining the fate of doubtful cream.

There is a limit to the capability of machinery and manufacturing technique to offset defects in cream quality, and no factory can afford to slur over defects in the cream received. Any laxity in this respect is really doing the farmer a disservice, for he may remain unaware that better quality cream is required, and takes less, instead of more care on the farm.

First quality butter can only be obtained when the farmer realises that the remedy for cream defects is essentially his responsibility.

Seasonal Notes for Wheat Areas.

As a result of the recent rains the surface mulch has probably been destroyed on most of the early well-worked fallows intended for wheat, and will, of necessity, have to be restored by further cultivation. Weed growth will also require early destruction in order to avoid depletion of the moisture reserves in the soil.

The land should not be worked to a greater depth than 4 inches. Wheat requires a firm seed-bed for its successful development. Deep cultivation is consequently not essential, and if attempted at this time of the year may adversely affect the prospective crop, more particularly if it is intended solely for grain.

Deep working may also bring to the surface weed seeds lying dormant in the soil. These may germinate with the wheat, and actively compete with the crop.

When ordering seed purchasers should state whether the wheat is required for early or late sowing. This is essential, because early wheats, such as Florence and Seaspray, are suitable for late sowing. Late varieties, such as Currawa, Cleveland, Warren, and Ford, are slow maturing types adapted for early sowing.

Prairie Grass Seed.

Large quantities of prairie grass seed are now being purchased by stock-owners in anticipation of early sowings. It is well known that commercial prairie grass seed is not of uniform quality, and when purchasers of this seed are not certain of the germinating capacity of the seed bought, samples should be submitted to the Department of Agriculture and Stock for examination. Samples should be addressed to "The Officer-in-charge, Seed Laboratory, Department of Agriculture and Stock, Brisbane," and will be examined free of charge provided that following particulars are written in ink on the packet containing the sample:—

(1) The name under which the seed was purchased;
(2) The number of bags from which the sample was drawn, and the number of bags in the whole consignment;
(3) The marks of identification, if any, on such bags;
(4) The name and address of the sender, with date of sampling;
(5) The name and address of the sender's supplier, with date of delivery.

The usefulness of prairie grass for grazing and seed production purposes has been seriously impaired by the widespread occurrence of smut in the seedheads. Tests carried out by the Department of Agriculture and Stock have shown that the disease may be controlled by treating the seed before sowing with a mercury dust or with formalin solution. The mercury dust (Abavit B or Ceresan) should be applied at the rate of 3 oz. for every 20 lb. of prairie grass seed. The dust and seed should be thoroughly mixed by rotating together in a closed container. If a mercury dust is unobtainable the seed, on the day prior to sowing, should be spread out on a smooth floor or tarpaulin, and sprinkled with a formalin solution made up by adding 1 pint of commercial (40 per cent.) formalin to 30 gallons of water. About a gallon is required for each bushel of seed to be treated. The seed should be thoroughly moistened, covered with moist bags, and left overnight.

Orchard Notes

JUNE.

THE COASTAL DISTRICTS.

THE remarks that have appeared in these notes for the past two months apply in a great measure to June as well, as the advice that has been given regarding the handling, grading, packing, and marketing of the citrus crop still holds good. As the weather gets cooler the losses due to the ravages of fruit flies will decrease. The absence of flies does not, however, permit of any relaxation in the care that must be taken with the fruit, even though there may be many less injured fruit, owing to the absence of fruit-fly punctures, as there is always a percentage of damaged fruit which is liable to blue mould infection, which must be picked out from all consignments before they are sent to the Southern States if a satisfactory return is to be expected. If the weather is dry, citrus orchards must be kept in a good state of tilth and any winter green manure crops turned under, otherwise the trees may get a setback. Old worn-out trees may be dug out and burnt; be sure, however, to see that they *are* worn out, as many an old and apparently useless tree can be brought round and made to bear good crops, provided the trunk and main roots are still sound, even though the top of the tree is more or less dead. The whole of the top of the tree should be cut off and only the trunk and such sound main limbs left as are required to make a new head. The earth should be taken away from around the collar of the tree, and the main roots exposed, any dead roots being cut away and removed. The whole of the tree above ground and the main roots should then be dressed with a strong lime sulphur wash or Bordeaux paste. The main roots should be exposed for some time, not opened up and filled in at once. Custard apples will be ripening more slowly as the nights get colder. If the weather becomes unduly cold, or if immature fruit is sent South, the fruit is apt to turn black and be of no value. This can easily be overcome by subjecting the fruit to artificial heat, as is done in the case of bananas, during the cooler part of the year, when it will ripen up properly and develop its flavour. Grade custard apples carefully, and pack in cases holding a single layer of fruit only for the Southern markets.

Pineapples, when at all likely to be injured by frost, should be protected by a thin covering of bush hay or similar material. The plantation should be kept well worked and free from weeds. The fruit takes longer to mature at this time of the year; consequently it can be allowed to remain on the plant till partly coloured before gathering for the Southern markets, or can be fully coloured for local use.

Banana plantations must be kept worked and free from weeds, especially if the weather is dry, as a severe check to the plants now means small fruit later on. Bananas should be allowed to become full before the fruit is cut, as they will carry all right at this time of the year; in fact there is more danger of their being injured by cold when passing through New England by train than there is of their ripening up too quickly.

Bear in mind the advice given with regard to the handling, grading, and packing of the fruit. It will pay you to do so. Land intended for planting with bananas or pineapples during the spring should be got ready now.

Strawberries require constant attention, and unless there is a regular and abundant rainfall, they should be watered regularly. In fact, in normal seasons an adequate supply of water is essential, as the plants soon suffer from dry weather or strong, cold westerly winds. Where not already done, vineyards should be cleaned up ready for pruning—it is, however, too early to prune or to plant out new vineyards.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

ALL kinds of deciduous fruit trees are now ready for pruning, and this is the principal work of the month in the orchards of the Granite Belt area. Don't be frightened to thin out young trees properly, or to cut back hard—many good trees are ruined by insufficient or bad pruning during the first three years. If you do not know how to prune, do not touch your trees, but get practical advice and instructions from one or other of the Departmental officers stationed in the district. In old orchards, do not have too much bearing wood; cut out severely, especially in the case of peaches, or you are likely to get a quantity of small unsaleable fruit. There are far too many useless and unprofitable fruit trees in the Granite Belt area, which are nothing more or less than breeding-grounds for pests, such as fruit-fly, and are a menace to the district. Now is the time to get rid of them. If such trees are old and worn-out, take them out and burn them, but if they are still vigorous, cut all the tops off and work them over with better varieties in the coming season—apples by grafting in spring and peaches and other stone fruits by budding on to young growth in summer. Planting can start now where the land is ready and the trees are to hand, as early-planted trees become well established before spring, and thus get a good start. Be very careful what you plant. Stick to varieties of proved merit, and few at that, and give so-called novelties and inferior sorts a wide berth. Take the advice of old growers, and do not waste time experimenting with sorts that have probably been tested in the district, and turned down years ago. When land is intended for planting this season, see that it is well prepared and well sweetened before the trees are put in, as young trees seldom make a good start when planted in sour and badly prepared land.

Slowly acting manures—such as bonedust, meatworks manure, or island phosphates—can be applied now, as they are not liable to be washed out of the soil, and they will be available for the use of the trees when they start growth in spring. Lime can also be applied where required. Badly drained land should be attended to, as no fruit trees will thrive with stagnant water lying round their roots.

On the Downs and Tableland all kinds of fruit trees can be pruned now, and vines can be pruned also in any district where there is no danger from late frosts, and where this can be done the prunings should be gathered and burnt, and the vineyards ploughed up and well worked to reduce the soil to a good state of tilth, so that should rain come it will absorb all that falls and the moisture can be kept in the soil by cultivation subsequently.

Citrus fruits will be at their best in the western districts. The trees should be watered if they show signs of distress; otherwise all that is necessary is to keep the surface of the land well worked. All main-crop lemons should be cut by this time, as if allowed to remain longer on the tree, they only become overgrown and are more suitable for the manufacture of peel, whereas if cut and cased now they will keep in good order so that they can be used during the hot weather.

RECORD WEIGHT LITTER.

A remarkably good performance was made by the litter of twelve Wessex Saddleback pigs owned by Mr. R. Turpin, Lowood, which was officially weighed at eight weeks old by the Department of Agriculture and Stock. The total litter weight of 624½ lb. at eight weeks old is the heaviest yet recorded by this Department.

LITTER RECORD.

Owner.—R. Turpin, Pensilva Stud, Lowood.

Dam of Litter.—Pensilva Ace 3rd., Wessex Saddleback.

Sire of Litter.—Long Park Champion (imp.), Wessex Saddleback.

Litter Born On.—8th February, 1937.

Total Litter Weight at Eight Weeks.—624½ lb.

Average Weight per Pig at Eight Weeks.—52 lb.

Farm Notes

JUNE.

FIELD.—Winter has set in, and frosts will already have been experienced in some of the more exposed districts of the Maranoa and Darling Downs. Hence insect pests will to a great extent cease from troubling, and weeds will also be no serious drawback to cultivation. Wheat sowing should now be in full swing, and in connection with this important operation should be emphasised the necessity of at all times treating seed wheat by means of fungicides prior to sowing. Full directions for ''pickling'' wheat by copper carbonate treatment are available on application to the Department of Agriculture, Brisbane. Land intended for the production of early summer crops may now receive its preliminary preparation, and every opportunity taken advantage of to conserve moisture in the form of rainfall where experienced; more particularly so where it is intended to plant potatoes or early maize. Where frosts are not to be feared the planting of potatoes may take place in mid-July; but August is the recognised month for this operation. Arrowroot will be nearly ready for digging, but we would not advise taking up the bulbs until the frosts of July have occurred. Take up sweet potatoes, yams, and ginger. Should there be a heavy crop, and consequently a glut in the market, sweet potatoes may be kept by storing them under cover and in a cool place in dry sand, taking care that they are thoroughly ripe before digging. The ripeness may be known by the milky juice of a broken tuber remaining white when dry. Should the juice turn dark, the potato is unripe and will rot or dry up and shrivel in the sand pit. Before pitting, spread the tubers out in a dry barn, or in the open if the weather be fine. In pitting them or storing them in hills, lay them on a thick layer of sand; then pour dry sand over them till all the crevices are filled and a layer of sand is formed above them; then put down another layer of tubers, and repeat the process until the hill is of the requisite size, and finally cover with either straw or fresh hay. The sand excludes the air, and the potatoes will keep right through the winter. In tropical Queensland the bulk of the coffee crop should be off by the end of July. Yams may be unearthed. Sugar-cane cutting may be commenced. Keep the cultivator moving amongst the pineapples. Gather all ripe bananas.

Cotton crops are now fast approaching the final stage of harvesting. Growers are advised that all bales and bags should be legibly branded with the owners' initials. In this matter the consignor is usually most careless, causing much delay and trouble in identifying parcels, which are frequently received minus address labels.

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SHEEP LAND FOR SELECTION AT CUNNAMULLA.

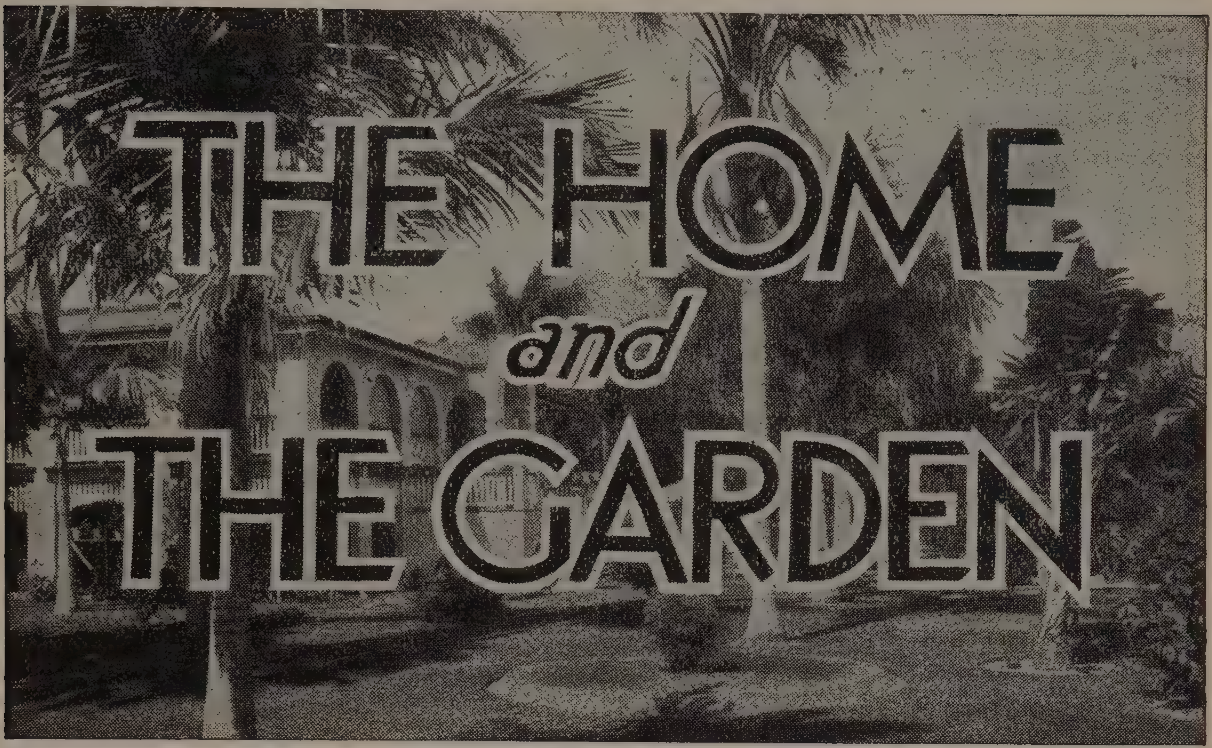
Portion 6, parish of Jumna, comprising part of the resumption from Charlotte Plains Holding, situated about 25 miles east from Cunnamulla, will be open for Grazing Homestead Selection at the Land Office, Cunnamulla, on Monday, 10th May, 1937, at 11 a.m. The area of the portion is 21,000 acres.

The selection will be for a term of 28 years, and the annual rent for the first seven (7) years will be 2¾d. per acre.

The selection must be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of three years, and must be enclosed with a rabbit-proof fence during the same period.

The land is well shaded and is good breeding and fattening country. It is watered by two bore drains, but additional water will be required.

Free lithographs and full particulars may be obtained from the Lands Department, Brisbane, the Land Agent at Cunnamulla, and the Government Tourist Bureaux, Sydney and Melbourne.



OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

MALNUTRITION.

IT is unfortunately true that slight degrees of malnutrition pass unnoticed in very many little children. Nobody thinks very much about the children who are simply a bit "below par." It is most important that parents and others should know the signs indicating that a child is malnourished, and should be alert to seek advice and apply it at once.

SIGNS OF UNDER-NOURISHMENT.

An under-nourished child is usually below the standard weight for his age and height.

He does not gain in weight as he should, and is more or less soft and flabby.

His appetite is usually poor or erratic, and he is "finicky" about his food, habitually refusing certain articles of diet—usually some of those necessary for good health—milk or vegetables, for instance.

He gets tired easily, is inclined to be listless, has dark rings under his eyes, and stands badly.

He is more or less fretful and nervous, and "whiney" without apparent cause.

He lacks that indefinable air of joyous elasticity and buoyancy which is characteristic of the perfectly healthy small child.

It cannot be over-emphasised that the child who drifts along through the pre-school period in this condition enters the rough-and-tumble and the competition of school life *handicapped*. Unless something is done to remove the causes of his poor condition the chances are that he will emerge from school days still handicapped for the battle of adult life.

Is your child "below par?" If so, parents should ask themselves these questions:—

What are the child's food habits?

Does he eat good, wholesome food suitable for his age? Does he "chew" it properly? Does he have three good meals a day only, or does he have sweeties and pieces between meals? Are meal times cheerful, happy times?

What are his habits generally?

Are the bowels regular or is he constipated? Does he have regular rest and sleep? Is proper cleanliness of body and teeth observed?

Does he get over-fatigued?

Are his activities too stimulating and too continuous? Does he have to walk beyond his powers?

Is he happy—"blithe, bonny, good, and gay"?

Is the home atmosphere such that personality as well as body may develop freely?

Has he any physical defects—decayed teeth, adenoids, ear or eye troubles, etc.?

Earnest examination of the child's habits and environment rarely fails to reveal the cause or causes of malnutrition. Regular periodical inspection by a trained person is the greatest possible help and protection to the health of the pre-school child.

IN THE FARM KITCHEN.

WAYS OF USING LEFT-OVER MEAT.

Potato Bridies.

Take 4 oz. scraps of cold meat, ¼ gill stock or gravy, 1 level teaspoonful flour, salt and pepper.

Mix the flour, seasoning, and stock. Bring them to the boil and add the finely minced meat. Re-heat the mixture and turn it out to cool.

Make a potato paste by kneading one level tablespoonful of flour with a little salt into each heaped tablespoonful of finely mashed potato, and when smooth roll it out thinly. Cut the paste into rounds, about the diameter of a breakfast cup. Put a little of the meat mixture into each round, damp the edges, fold over the paste, and fix the edges securely together. Fry them in deep, hot fat.

Bengal Mince.

Take 4 oz. rice, 2 oz. butter, ½ lb. onions, 10 oz. cold meat, 2½ gills stock or gravy, 3 teaspoonfuls curry-powder, 1¼ oz. flour, seasoning.

Wash the rice and cook it in boiling water until tender, then drain it in a colander. Pour cold water through to separate the grains, and drain it again. Peel and mince the onions, fry them until slightly browned in the butter. Lift out half of them and put them into a saucepan. Stir two teaspoonfuls of curry-powder into the remaining onions and butter, and, when blended, add the rice and make it hot. Add a teaspoonful of curry-powder to the onions in the saucepan, cook them a minute, then add the stock (or gravy) and stir in the flour, smoothed in a little water. Boil for a few minutes, then mince the meat and add it. Season the mince and make it hot; if not brown enough add a few drops of browning. Heap the prepared rice in the centre of a hot dish, pour the mince round it, and garnish with sippets of toast. If the mince is too thick thin it down with a little more stock.

Meat Mould.

Take 10 oz. cold meat, 1½ oz. breadcrumbs, 1 small onion, 2 eggs, salt, pepper, and stock (if required).

Peel and finely chop the onion and fry for a few minutes, then strain off the fat. Boil one egg for about fifteen minutes, until hard, then remove the shell and chop up the egg finely. Mince the meat and mix with the onion and chopped egg. Make the breadcrumbs and add. Season well to taste and mix all well together. Beat up the remaining egg and bind the prepared ingredients. If any more moisture is needed a little stock may be added, but the mixture should be quite stiff. Put into a well-greased mould or pie-dish, pressing it down firmly. Cover with a greased paper and bake in a moderately hot oven for about thirty-five minutes. Turn out carefully and serve cold. If the meat is all lean, add a little melted butter to the mixture, in which case no stock would be needed. This is an excellent method of using up cold meat, more especially if the latter is rather underdone. Slices of the meat mould put between bread and butter will make tasty sandwiches.

Venetian Minced Beef.

Take 2 onions, ¾ oz. flour, ¼ lb. spaghetti, ½ pint stock (more if required), 1 small tin peeled tomatoes, 10 oz. cold beef, seasoning, butter, or dripping.

Peel and mince the onions, and fry them gently till golden in a little hot fat. Then pour off the fat that remains. Add the stock, and stir in the flour, smoothed in a little water. Bring it to the boil, and boil for two or three minutes, add a little browning as required. Meanwhile, cook the spaghetti in a pan of slightly boiling water. When it is tender drain it, and return it to the pan with the liquor drained from the tin of tomatoes. Simmer gently for a few minutes. Add the drained tomatoes to the gravy. Mince the meat and add it, together with seasoning to taste. Make the mixture thoroughly hot, turn it on to a dish, and serve it with a border of the prepared spaghetti.

Beef Rolys.

Take 3 oz. cold beef, 6 oz. cold potato, 1 dessertspoonful minced onion, 2 or 3 dessertspoonfuls thick tomato sauce, pepper and salt, ¾ lb. of short or flaky pastry.

Put the meat and potato through the mincer and mix them with the onion. Season to taste and moisten the mixture with tomato sauce. Divide it into eight portions and form each into a sausage shape. Roll out the pastry fairly thinly, and cut oblong-shaped pieces, the same width as the rolls and long enough to reach round them.

Windsor Croquettes.

Take ¾ lb. cold meat, 1 egg-yolk, ½ small onion, 1 level tablespoonful breadcrumbs, ½ oz. flour, ½ oz. butter, 1 gill stock, pepper, salt, crushed herbs, Worcester sauce.

Melt a tablespoonful of butter in a saucepan, add an equal quantity of flour, stir it till it is frothy, then thin it down to a thick sauce with any meat stock. Keep stirring till the sauce boils. Then mince the meat finely. Beef, lamb, mutton, pork, veal, or chicken are all equally good for croquettes. Add the minced meat to the sauce. Season it well with pepper and salt, Worcester sauce, minced onion, and crushed herbs to taste. Stir in the crumbs and egg-yolk. When well blended spread the mixture on a plate, and when it is quite cold shape it into croquettes. Coat each one with egg and breadcrumbs and fry in a pan of hot, smoking fat.

Beef Rechauffe.

Take ½ lb. cold beef, 1 small tin peeled tomatoes, 2 onions, 1 teaspoonful flour, 1½ lb. mashed potatoes, seasoning, milk, 1 or 2 fresh tomatoes, margarine.

Peel and mince the onions, put them in a saucepan with a little fat, and cook them until tender and just lightly coloured. Draw the pan aside and drain off the fat. Add the contents of a small tin of peeled tomatoes and thicken the mixture with the flour, smoothed in a spoonful of water. Boil it for a few minutes, keeping it stirred, then take off the gas and let it cool. Boil the potatoes in the usual way and mash them. Season with pepper, add a lump of margarine, and moisten with a little milk. Put a thin layer of the mashed potato in the bottom of a fireproof dish, which has been well buttered. Mince the beef and mix it with the tomato and onion, season it and turn it into the dish, then heap the remainder of the potatoes on top to form a border. Put the rechauffe into the oven and make it hot. Garnish the centre with quarters of lightly baked fresh tomato, and serve immediately.

Mould of Lamb.

Take some cold lamb, 1 level teaspoonful salt, 1 cupful finely shredded cabbage, 1 tablespoonful lemon juice, 1 hard-boiled egg, ½ oz. gelatine, ½ pint water, 2 dessertspoonfuls castor sugar, ½ gill vinegar, 1½ pimentoes (tinned), 1 tablespoonful cooked peas.

Dissolve the gelatine in hot water and add the lemon juice to it, with the sugar, salt, and vinegar. Strain it and leave to cool. When it is beginning to stiffen add the chopped pimentoes, cabbage, peas, and slices of egg. Turn it into a wet mould and allow it to set. Turn the jelly out on to a dish lined with lettuce leaves. Border with overlapping slices of lamb and more lettuce leaves. Serve with tomatoes and mayonnaise.

Beehive Pudding.

Take 3 oz. macaroni, 1 cupful breadcrumbs, 1 cupful cold meat (chopped), 1 sliced tomato, 1 egg, salt, pepper, ½ oz. flour, 1 oz. butter, ½ gill milk, tomato sauce.

Put the macaroni and salt into a pan of boiling water. Boil it for thirty minutes and strain it. Let the macaroni cool. Grease a basin and sprinkle breadcrumbs over the inside. Line the basin round and round with long pieces of macaroni, pressing it against the basin and adding a few breadcrumbs to make it keep in place. Fry the tomato in the butter for five minutes, and stir in the flour and chopped meat. Season to taste and add the rest of the breadcrumbs and macaroni. Bind with the beaten egg and milk, and fill the basin with the mixture. Cover with greased paper and steam for one hour. Leave for five minutes. Turn out carefully and serve with tomato sauce.

Tomato Sauce.

Take 1 lb. tomatoes, ½ onion, 1 bayleaf, 1 oz. butter, 1 oz. flour, ¾ gill water, pepper and salt.

Peel and chop the onion and slice the tomatoes. Melt the butter, put in the onion, bayleaf, and tomatoes, and simmer very gently for twenty minutes. Rub the sauce through a sieve. Mix the flour smoothly with the water. Put it with the tomatoes in a saucepan and stir till boiling. Boil for five minutes and season with pepper and salt.

POINTS FOR BEEKEEPERS.

In most beekeeping localities there are several nectar flows during the season, and at the termination of each flow there is a tendency for the bees to commence robbing each others' hives of their stores. Great care should be taken not to leave honey or pieces of comb lying about where bees can obtain access to them, nor should hives be left open longer than is necessary.

It is usually at the termination of the last nectar flow of the season that attempts by the bees to rob each other's stores are most marked, and attempts are then made to open hives for the purpose of extracting the last honey. The disturbance is sometimes so great that further work becomes impossible. At such times bees will enter the honey-house in thousands should the door have been inadvertently left open, and even the kitchen at home will be invaded if open vessels of honey be left exposed. When this happens the first thought is to close the door, but it is not to be recommended. It is far better to go inside and cut off the supply, and to see that all tanks, super-bodies, and tins are closed and made absolutely bee-proof. When all honey and other sweets are safe leave the honey-house door open until every bee is satisfied that there is nothing to be gained by going in. It takes a day for them to realise this, so that when darkness falls the honey-house should be closed.

If it is imperative that extraction should proceed the beekeeper should use a bee-escape fitted to a thin board the full size of the hive. On one side of the board slats are nailed to slightly raise the super from the brood chamber. A hole corresponding to the one on the escape is then bored through the centre of the board and the escape tacked over it. The bee-escape should be placed below the honey super, and the bees will pass through the escape to the brood nest below but are unable to return, and if the escapes are placed on the hives in the evening the supers may be removed practically free of bees early the next morning, and may be quickly carried to the extracting house without causing excitement among the other bees. It is useless, however, to attempt using a bee-escape if any brood is present in the honey super, as the bees will not leave.—H. HACKER, Apiary Inspector.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF MARCH IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1937 AND 1936, FOR COMPARISON.

Divisions and Stations.	AVERAGE RAINFALL.		TOTAL RAINFALL.	
	Mar. 1936.	No. of Years' Records.	Mar. 1937.	Mar. 1936.
North Coast.	In.		In.	In.
Atherton	8·76	36	7·45	10·36
Cairns	18·10	55	15·80	12·76
Cardwell	15·62	65	32·23	21·16
Cooktown	15·26	61	17·75	14·48
Herberton	7·76	51	6·38	11·16
Ingham	15·69	45	33·74	28·51
Innisfail	26·33	56	48·99	24·96
Mossman Mill	18·08	24	19·98	19·39
Townsville	7·16	66	9·74	9·44
Central Coast.				
Ayr	6·42	50	9·63	12·33
Bowen	5·76	66	6·98	26·16
Charters Towers	3·71	55	6·30	7·33
Mackay	11·93	66	21·19	31·53
Prosperine	12·15	34	24·88	35·56
St. Lawrence	5·11	66	10·59	4·47
South Coast.				
Biggenden	3·65	38	14·95	4·06
Bundaberg	4·97	54	16·60	8·45
Brisbane	5·60	85	7·26	5·96
Caboolture	7·44	50	9·15	10·93
Childers	4·33	42	17·95	6·43
Crohamhurst	10·93	44	14·17	18·80
Esk	4·58	50	9·38	4·28
Gayndah	2·96	66	5·36	2·49
Gympie	6·03	67	16·87	7·83
Kilkivan	3·75	58	9·82	5·17
Maryborough	5·76	66	13·03	5·32
Nambour	8·99	41	19·77	14·34
Nanango	3·27	55	6·74	3·76
Rockhampton	4·31	66	7·37	5·10
Woodford	7·68	50	8·67	12·25
Central Highlands.	In.		In.	In.
Clermont	3·06	66	4·06	8·52
Gindie	2·56	38	..	7·85
Springsure	2·87	68	3·64	5·55
Darling Downs.				
Dalby	2·61	67	6·92	4·04
Emu Vale	2·22	41	4·11	1·70
Hermitage	1·95	31	..	1·38
Jimbour	2·43	49	4·96	2·63
Miles	2·60	52	6·79	5·15
Stanthorpe	2·59	64	4·52	4·47
Toowoomba	3·62	65	9·84	3·68
Warwick	2·41	72	6·94	1·92
Maranoa.				
Roma	2·56	63	7·32	7·05
State Farms, &c.				
Bungeworgorai	1·39	22	..	6·98
Gatton College	3·03	38	7·12	2·84
Kairi	7·88	21	..	11·63
Mackay Sugar Experiment Station	10·93	40	18·03	36·97

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—MARCH, 1937.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure Means at 9 a.m.	SHADE TEMPERATURE.						RAINFALL.	
		Means.		Extremes.				Total.	Wet Days.
		Max.	Min.	Max.	Date.	Min.	Date.		
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·78	86	75	92	15	71	25	1,775	22
Herberton	..	78	64	83	19	56	29	638	15
Rockhampton	29·92	86	70	93	28	65	30	737	10
Brisbane	30·01	82	66	97	28	63	4	726	12
Darling Downs.									
Dalby	29·99	84	60	92	28	46	30	692	6
Stanthorpe	..	76	54	87	27	40	29	452	8
Toowoomba	..	78	58	90	28	56	30	984	6
Mid-Interior.									
Georgetown	29·82	89	69	94	8	60	30	1,079	10
Longreach	29·89	90	66	97	28	57	30	609	5
Mitchell	29·97	84	59	92	27, 28	43	30	426	4
Western									
Burketown	29·79	91	74	96	7, 29	66	17	229	4
Boulia	29·84	93	70	101	1, 8	58	29	108	2
Thargomindah	29·94	91	67	103	27	56	29	4	1

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	May. 1937.		June. 1937.		MOONRISE.	
					May. 1937.	June. 1937.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	6.18	5·20	6.37	5·2	9.39	11·11
2	6·18	5·19	6·37	5·2	10·29	—
						a.m.
3	6·19	5·18	6·38	5·2	11·24	12·10
4	6·20	5·17	6·38	5·2	..	1·9
					a.m.	
5	6·20	5·17	6·39	5·2	12·22	2·11
6	6·21	5·16	6·39	5·2	1.20	3·18
7	6·21	5·15	6·39	5·2	2·20	4·25
8	6·22	5·14	6·40	5·2	3·23	5·35
9	6·23	5·14	6·40	5·3	4·31	6·39
10	6·23	5·13	6·40	5·3	5·39	7·42
11	6·24	5·12	6·41	5·3	6·50	8·36
12	6·24	5·11	6·41	5·3	7·59	9·23
13	6·25	5·11	6·41	5·3	9·3	10.6
14	6·26	5·10	6·42	5·3	10·3	10·44
15	6·26	5·10	6·42	5·3	10·47	11·25
16	6·27	5·9	6·42	5·3	11·31	11·51
					p.m.	p.m.
17	6·27	5·9	6·43	5·4	12·10	12·25
18	6·28	5·8	6·43	5·4	12·45	1·0
19	6·29	5·8	6·43	5·4	1·18	1·35
20	6·29	5·7	6·43	5·4	1·50	2·14
21	6·30	5·7	6·44	5·4	2·23	2·54
22	9·31	5·6	6·44	5·4	2·58	3·40
23	6·31	5·6	6·44	5·4	3·36	4·29
24	6·32	5·5	6·44	5·4	4·14	5·23
25	6·32	5·5	6·44	5·5	4·56	6·18
26	6·33	5·4	6·45	5·5	5·44	7·13
27	6·34	5·4	6·45	5·5	6·34	8.9
28	6.34	5·3	6·45	5·5	7·27	9·6
29	6·35	5·3	6·45	5·5	8·23	10·4
30	6·35	5·2	6·45	5·5	9·19	11·1
31	6·36	5·2			10·15	

Phases of the Moon, Occultations, &c.

4th May.	☽	Last Quarter	4 36 a.m.
10th ,,	●	New Moon	11 17 p.m.
17th ,,	☾	First Quarter	4 49 p.m.
25th ,,	○	Full Moon	5 38 p.m.

Perigee, 11th May, at 4 a.m.
Apogee, 24th May, at 11 p.m.

On the 19th Mars will be in opposition to the Sun, rising as the Sun sets. Having moved with retrograde motion since 21st April it will again be seen near the head of the Scorpion as on that date.

On the 23rd Mercury will be stationary. Having apparently moved westward in Aries since the beginning of the month it will then resume its eastward course.

Neptune, in Leo, near the border of Virgo, will become stationary on the 28th. The remote planet, only visible in a telescope, might seem uninteresting to the ordinary observer were it not for the romantic story of its discovery by two young scientists simultaneously, and unknown to each other, Adams in England, and Leverrier in France, not by actual observation but by intricate calculation at their study table. That was in 1845, and then it was found that Adams' calculations differed by one degree only from those of Leverrier. Soon afterwards Dr. Galle in Berlin discovered the planet by observation only a few degrees from the position in Aquarius indicated by Leverrier—and Neptune had wandered into the empty space shown on the famous star maps of Berlin.

Mercury rises at 7.26 a.m., 1 hour 8 minutes after the Sun, and sets at 6.2 p.m., 42 minutes after it on the 1st; on the 15th it rises at 6.0 a.m., 26 minutes before the Sun, and sets at 4.54 p.m., 16 minutes before it.

Venus rises at 4.52 a.m., 1 hour 26 minutes before the Sun, and sets at 4.6 p.m., 1 hour 14 minutes before it on the 1st; on the 15th it rises at 3.52 a.m., 2 hours 34 minutes before the Sun, and sets at 3.20 p.m., 1 hour 50 minutes before it.

Mar rises at 6.31 p.m. and sets at 8.19 a.m. on the 1st; on the 15th it rises at 5.17 p.m. and sets at 7.11 a.m.

Jupiter rises at 10.19 p.m. and sets at 12.9 p.m. on the 1st; on the 15th it rises at 9.24 p.m. and sets at 11.18 a.m.

Saturn rises at 3.17 a.m. and sets at 3.31 p.m. on the 1st; on the 15th it rises at 2.27 a.m. and sets at 2.41 p.m.

The Southern Cross will be visible soon after sunset and until it fades in the approaching daylight.

2 June	☽	Last Quarter	3 24 a.m.
9 ,,	●	New Moon	6 43 a.m.
16 ,,	☾	First Quarter	5 3 a.m.
24 ,,	○	Full Moon	9 0 a.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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QUEENSLAND AGRICULTURAL JOURNAL

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Event and Comment

Progressive Departmental Policy.

ADDRESSING a recent field-day gathering at Nambour, the Minister for Agriculture and Stock (Hon. Frank W. Bulcock) remarked that the large assemblage of fruitgrowers was impressive evidence of a very keen interest in orchard problems in Queensland. Referring to the series of field demonstrations that had been arranged for the occasion by officers of his Department, the Minister said that it was only by such means and the provision of experimental plots that the application of science to agriculture could be demonstrated in a practical way. What was being done at the present time was of advantage to both the individual and the State generally. The Department of Agriculture had pursued a progressive policy as well as an economic one. The Maroochy district had a fascination for him, the region containing possibilities that were not found in any other part of the State. His officers were zealous and keen and anxious to advance their work in the interests of agriculture in Queensland. The Department formed a triple alliance in which the Minister, the officers, and the producers each played their essential part.

Continuing, the Minister said that new possibilities were being opened up on the economic side of agriculture. The object was to make agriculture a much more agreeable occupation, and to make it as efficient as possible. In every primary industry the scientific aspect was given greater consideration than ever. The remarkable efficiency of the Queensland sugar industry was an outstanding example of the value of science in primary production.

Supporting Mr. Bulcock's remarks, Mr. H. F. Walker, M.L.A., said that the Department of Agriculture, of which he was a former Minister, was conducted on a high plane of efficiency. He considered that the field days and the demonstrations given on experimental plots were of great benefit to the pineapple or any other industry, and the more the scientific side was encouraged the greater would be the development of all phases of their primary industries.

Mr. F. Nicklin, M.L.A., also spoke in commendatory terms of the work of officers of the Department. Great interest, he said, had been taken in the field demonstrations, from which growers were receiving untold advantages. Much had been achieved by the adoption of scientific methods in the cultivation of the pineapple, and this was all pointing to the importance of producing a better article for canning and the home market.

Dealing with marketing, Mr. Nicklin said the idea was to improve the quality of the pack wherever possible. The Department's efforts along these lines were bearing fruit already. In a marketing policy they needed the growers' wholehearted support, and anything that was done should be for the general advancement of the growers and the industry.

Loyalty to Co-operative Organisations.

IN the course of his address to the fruitgrowers at Nambour, Mr. Bulcock spoke of the necessity of primary producers remaining loyal to their organisations. The responsibility for their success or failure, he said, rested on individual members, and it was the duty of everyone to pull his weight. Any man selling outside his commodity board or outside the Committee of Direction might do quite well for a time, but eventually it tended to break up the scheme and the advantages of stabilised marketing.

Mr. Bulcock added that the pineapple-growers were now required to make important decisions, in the formulation of a scheme in connection with their industry through their sectional group committees and the Committee of Direction. In connection with any decision that the growers themselves might make it would be wise to see that they were wholehearted in any project undertaken, and before they embarked on any scheme in respect to the matter of canned pineapples they should be satisfied it was economically sound. He could assure them that as Minister every consideration would be given to a scheme with which the growers were unanimous. Whatever action was taken to protect economic interests he would be happy to assist as long as it was calculated to help the industry. He, however, urged strongly on the growers to discuss thoroughly and examine any proposition which was put forward, and when they had arrived at a decision to stand loyally by it. If they intended to venture into a new phase of the industry it would be necessary to investigate it from all angles. When they were satisfied that they had arrived at a stage of unanimity they could then approach the Government, which would give effect to it, if found practicable.

Fodder and Water Conservation.

SPEAKING at an annual agricultural show function at Wondai in the course of the month, Mr. Bulcock made an important announcement on the subject of fodder and water conservation. He said, *inter alia*:—

"There is a growing consciousness of the importance of the part agriculture plays in the general scheme of things, and the value of science as the handmaid of agriculture . . . . Industries must be prepared to make contributions towards their own advancement. . . . The problems of agriculture may be divided into three phases—cultivation or production, scientific, and the marketing or economic phase. At one time production was the only problem, markets being automatic. The next phase was the scientific, and until the post-war period the economic and marketing phase had not been considered.

"We talk of progress, but we are only on the fringe of agriculture in Australia. We should make greater effort to prevent loss; our scientific knowledge is not sufficiently applied to agriculture. The recent drought in the coastal and semi-coastal areas of the State resulted in a loss of £5,000,000 to the people of Queensland, and the pastoral areas had previously suffered tremendous losses through drought. I have no time for those who say that such losses are non-preventible.

"We should aim to each year reduce our economic loss. In dairying, among other problems, we have that of the low quality product. The sooner such problems are faced, the greater the results—but there must be the fullest co-operation among all concerned. How can we do it?

"I have on my table probably a hundred schemes for the conservation of water and fodder. I have appointed a committee to investigate and, after they obtain correct answers to a questionnaire, I will convene a conference of all the interests concerned. This is a national matter, and all from the National Government to individual primary producers will need to co-operate; if such is done, a scheme which is worthwhile will be brought about. I will not admit that no one has the capacity to evolve such schemes to release from the major difficulties which beset it, agriculture, which should not be the vassal of other industries.

"Why should it be represented that there is any disparity between the social standing of those engaged in other industries and those engaged in the most skilful occupation of agriculture? Cheap newspapers delight in depicting 'Dad and Dave,' and legislation to eliminate such misrepresentations might even be warranted.

"The time is not far distant when I will be giving very active consideration to the problems of conservation of water and fodder. These coastal and semi-coastal areas must be enabled to produce not only their own fodder requirements, but also those of the western areas. I believe a practical policy can be enunciated. Why should Queensland almost every year purchase large quantities of fodder from the southern States?

"We have the lands with capacity for enormous production of fodder; all we lack is regularity of water supply, and on such regularity depends the advancement of agriculture in Queensland. I desire to bring to fruition schemes for conservation of water and of fodder, and that is also the desire of the Premier. I hope to be able to introduce in next session of Parliament legislation on such lines and calculated to be a material factor in advancing the State's agricultural prosperity."

A.M.L. cat. M.L

Seedling Pests of Cotton and Their Control.

W. J. S. SLOAN, B.Sc. Agr., Assistant Entomologist.

SPRING is a critical period for the cotton-grower, as failure to obtain a reasonable stand at this time of the year may greatly prejudice the success of the crop.

In young cotton, insect pests may impede the growth of the plant, produce a malformed bush, or totally destroy the seedlings. If seedling destruction is extensive, partial or complete replanting is then necessary, with a consequent loss of time and money. As some weeks may elapse before suitable rains permit replanting, the cotton may be unable to set an early crop of bolls. An early setting is desirable in order to minimise the adverse effects of possible subsequent unfavourable climatic conditions and further insect outbreaks.

The main pests associated with young cotton include cutworms, false wireworms, aphids, thrips, Jassids, grasshoppers, flea beetles, and corn ear worms. Larvæ of the cotton web-spinner may also cause considerable damage in some of the cotton-growing areas.

38 225 Cutworms are cosmopolitan pests which injure many different crops. The cutworm attacking cotton is the larva of a dark-brown moth,* and is a typical greyish-green or greyish-brown caterpillar, which grows up to an inch and a-half in length, and feeds at night both on the leaves and stem of the seedling. Trouble from this pest may be due to a migration from hosts outside the field or from weeds in the field itself.

The false wireworm is the larva of a beetle† which is a third to half an inch in length, is dark-grey in colour, and has longitudinally ribbed wings. The larva is thin, brown, shiny, and hard, and grows to an inch in length. Both adults and young may attack cotton seeds and seedlings. In the latter case, the larvæ attack the soft stem under the ground surface, while the adults injure the seedling by ringbarking it at or just above ground level.

The cotton aphid‡ is a small, soft-bodied insect usually living in colonies on the plant. The cream coloured immature forms are wingless but greenish-black winged adults occur in the colonies and are comparatively numerous during the autumn months. This insect appears on seedlings every season to a greater or lesser extent, and feeds mostly on the lower surface of the leaves. The foliage is distorted, and sometimes the central shoot may be killed, forcing the growth into two or more main branches—an undesirable feature in the cotton plant.

296 The cotton thrips§ is a small creamy-white insect which causes distortion of the leaves and main shoots. In heavily-infested seedlings the entire terminal bud may frequently be destroyed, and the plant makes no progress beyond the production of two thick seed leaves. Injured leaves usually show a silvered appearance on the under surface. This pest thrives on a variety of weeds—e.g., pigweeds and thistle, commonly found in cotton fields.

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* *Euxoa radians* Guen.

† *Dasus macleayi* Blk.

‡ *Aphis gossypii* Glov.

§ *Thrips tabaci* Lind.

The cotton-leaf hoppers or Jassids* are small, active, fly-like insects. There appear to be two or three species involved, a greenish winged form predominating. Infested plants show malformation of the leaves similar to that caused by the thrips and the cotton aphid. Heavy infestation may kill the foliage and sometimes the entire seedling if the weather is dry and soil moisture is low.

Grasshoppers damaging cotton seedlings belong to several species, and farmers are familiar with their main characteristics. The most troublesome are firstly a brown insect† which grows up to an inch and a-half in length, and secondly a large brown-winged species‡ which attains a length of approximately three inches, and has the immature stages prettily marked with yellow and brown patches. Both these grasshoppers are fond of weed hosts botanically related to cotton. The larger grasshopper is particularly common in softwood scrub areas.

The cotton flea beetles§ are small brown to black insects which derive their name from the nimble way in which they spring off a plant when disturbed. They feed on the web of the leaf, destroy buds, and sometimes chew into leaf petioles and the stem. Like the grasshoppers, they show a strong liking for native host plants which are allied to cotton.

The corn ear worm is the larva of a stout-bodied moth.|| The moth 34 has a wing expanse of about 1½ inches, the forewings being a reddish-pink, and the hind wings creamy-yellow with broad marginal areas of a smoky colour. When mature, the larva is about 1½ inches long. The colour of the larva varies considerably, shades of red, brown, yellow, and green being found in different individuals. The colours are arranged in stripes along the length of the body, adjacent bands being separated by irregular white lines just above the legs and along the back.

Damage from this pest may occur from migrations off host plants within and without the cotton field. The pest breeds on many plants, including maize, lucerne, pigweeds, bullhead, hogweed, thistles, wild gooseberry, and ragweed. Badly prepared land usually has patches of weeds on which the pest may breed. Cultivation of the cotton after the seedlings are up kills the weeds and leaves the pest no alternative but to attack the cotton.

Cotton paddocks, though themselves free of weeds, frequently suffer severe injury from invading swarms of corn ear worms. In this case the pest has bred up on nearby host plants, and when disturbed for some reason, they migrate rapidly in all directions. Should a cotton field be in the path of migration, the seedlings may be severely injured.

Corn ear worms injure the seedling by defoliating it, injuring the stem to cause a malformal bush, or entirely destroying it.

Unlike the above-mentioned pests which usually occur in some degree 25 34 each season, the cotton web-spinner¶ is only occasionally destructive. The moth is small, inconspicuous, and brown to fawn in colour. The larva is a light to dark-green coloured caterpillar, which spins a web profusely to form protecting tunnels. Fully matured, it is about three-quarters of an inch long. The female moth lays her eggs on many types of plants, including Noogoora and Bathurst burrs, certain weeds allied botanically to cotton, roly-poly, and the creeping saltbush. When the larvæ have consumed the readily available food supply, migration takes place. Occasionally cotton fields are close to the breeding centres and become infested by migrant larvæ. Leaves may be skeletonised, terminal buds eaten out, and the seedlings killed. Attacked plants are fouled with frass-cluttered webbing.

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* *Empoasca* spp.

† *Phaulacridium gemini* Sjöst.

‡ *Valanga irregularis* Walk.

§ *Nisotra breweri* Baily, and *N. submetallica* Blk.

✓|| *Heliothis obsoleta* Gn.

✓¶ *Loxostege affinitalis* Led.

Control Measures.

Cotton crops grown in Central Queensland are very prone to corn-ear worm attacks between January and April, as the weather is then very favourable for the rapid multiplication of the pest. As maturing cotton suffers less than younger plants, late-planted crops are invariably more severely attacked. Early planting is therefore desirable, and land should be prepared in good time to enable the farmer to take advantage of any planting rains in September and October, for conditions will usually be suitable then for rapid seed germination and development. Failure to do so considerably increases the danger of crop losses by insect pests.

The over-wintering stages of most insects require an appropriately moist and warm environment before adult emergence is possible. These adults require fresh host plants on which to breed. Even spring rains, which are insufficient to allow planting on prepared land, stimulate the general emergence of the over-wintering insects. These insects will lack suitable hosts, and neither they nor their progeny will survive very long. Hence, though early sowing is generally desirable, it can be assumed that when inadequate rainfall delays planting beyond October, conditions are unsuitable for an early increase in the pest population. Under these special circumstances, late planted crops may escape serious infestation.

Most pests of seedling cotton breed on various weeds, many of which germinate and grow rapidly with the late winter and spring rains. It is therefore essential to keep both fields and headlands clear of weeds for at least a month before planting. Cutworm attacks are particularly common in seedling cotton grown on sandy soils in which this precaution has not been taken. It is a most undesirable practice to plough, harrow, and plant practically in one operation, especially if the land is carrying a growth of weeds. In some years such a procedure may be quite successful, but in ordinary seasons, any cutworms present on the weeds may survive and later attack the cotton seedlings soon after they germinate.

If possible, cotton should not be planted close to weedy fields or paddocks growing maize, lucerne, and tomatoes. Many weeds and the three crops mentioned often carry heavy populations of the corn-ear worm, and lucerne occasionally may have, in addition, larvæ of the cotton web-spinner. Should the pest larvæ migrate from any of these hosts, the nearby cotton may be severely damaged before suitable control measures can be applied.

Old cultivation paddocks should not be abandoned to weeds. The volunteer growth which is liable to breed cotton pests can be suppressed at very little cost by establishing a Rhodes grass pasture.

Higher seed rates than are necessary to produce a normal stand of cotton should be used, for it is easier to thin out excess plants than to replant depleted stands. Losses from false wireworm can usually be avoided in this way, for sufficient plants survive to give a reasonable crop.

For the control of invading swarms of caterpillars, both the molasses-lead arsenate swabbing mixture and the usual cutworm bait are useful.

The swabbing mixture is prepared according to the following formula:—lead arsenate, 1 lb.; molasses, 1 gallon; water, 6 gallons. The lead arsenate and molasses are first thoroughly mixed in separate containers with small quantities of water. They are then added to each other, and the whole made up to 6 gallons, the mixture being thoroughly stirred. The fluid so prepared is flipped on to plants in both the infested rows and a number in front of the swarm with a white-wash brush or a bundle of straw.

Freshly cut weed hosts, such as pigweeds and hogweed, dipped in the swabbing solution and spread as a barrier in front of the invading larval swarm, make an efficient and cheap bait.

The Paris green-bran cutworm bait formula is as follows:—Paris green, 1 lb.; molasses, 2 quarts; bran, 25 lb.; water, 2 to 2½ gallons. The Paris green and bran are thoroughly mixed dry, and the water in which the molasses has been dissolved is added to the mixture to make a friable crumbly mash. This bait is either scattered in front of the caterpillars and around the plants or distributed along the bottom of ploughed furrows separating the crop from the migrating pests.

Where the plants are very small, the use of baits is preferable to the swabbing method, for young plants treated with the swabbing fluid are often badly injured before the larvæ obtain a lethal dose of the poison. However, once the plants are established, swabbing with the sweetened poisoned solution is the most effective way of destroying the pests.

The cutworm bait scattered under and around the plants is a very successful method for combating cutworms and grasshoppers when they become established in a field. It is also effective in reducing the field population of adult beetles of the false wireworm.

Care must be exercised in the use of the swabbing mixture and the cutworm bait, for both contain a very poisonous chemical.

SCUMMY CREAM.

It frequently happens that when cream is being put through the strainer into the vat at a factory, a quantity of thick greasy substance is retained by the strainer. In most cases this is due to the inclusion of the thick scum from the interior of the separator bowl with the cream. This is a practice which cannot be condemned too severely and results frequently in the cream being graded down.

The Squirter Disease in Bananas with Special Reference to Its Control.

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THE squirter disease of bananas, whilst well known to southern merchants and retailers, is merely a name to most banana-growers since it makes its appearance only as the fruit ripens and is rarely seen on the plantation. Nevertheless it is recognised as being one of the most serious, if not the most serious, transport disease affecting Australian bananas.

The symptoms consist of a dark watery rot which appears first along the centre of the pulp of the fruit—whence it extends outwards. In the early stages of infection it is usually impossible to recognise the disease on external examination. In more advanced stages the fruit is soft under pressure, this softness being towards the stalk end, but, until the flesh becomes semi-liquid so that it squirts out when pressed the disease can only be diagnosed by an examination of the interior. The affected fruit may be represented by a few scattered individuals in the case or may be as many as twenty-five to thirty per cent. and occasionally even more.

The difficulty in detecting the presence of squirter by a superficial examination of the case results in a very important indirect loss due to the prejudice formed against certain brands. Buyers tend to ''hold off'' consignments which, by experience, are known to have come from a grower who has previously forwarded affected fruit. There is also, naturally, a decreased demand by the consumer during periods when squirter affected fruit is in evidence.

Squirter is of importance only during the winter and early summer, mainly in the months from April to November, inclusive. Isolated cases have been recorded during December, January and March.

The Development of Ideas Regarding the Cause of Squirter.

The investigation of the cause and control of squirter has had a somewhat chequered history. A trouble referred to under this name was known as far back as 1920. An enquiry into the cause of the disease was first undertaken by Goddard [1] who came to the conclusion after several years' work that cool temperatures in the winter produced a physiological state of the fruit which responded to unsuitable temperature or other conditions during transport with an ensuing development of squirter. Young, Bagster, Hicks, and Huelin[10], in a report on the ripening and transport of the Cavindish banana, recorded some interesting experiments in which they showed that bananas held for several days at a temperature of 53 deg. Fahr. or lower developed a much higher percentage of squirter than those not subjected to chilling. These authors considered that exposure to low temperatures during storage or transport might accentuate the trouble which appeared to be, at least in part, due to some predisposing condition developed on the plantation. King[6], who carried out a soil survey in connection with the

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For a more detailed account of squirter the reader is referred to McLennan and Hoette[8], Magee[7], and Simmonds[9].

incidence of squirter, came to the conclusion that soil type had no effect on the development of the disease. He noted the association of squirter losses with cold situations and suggested that a cold period might cause a cessation of certain physiological processes rendering the fruit more subject to breakdown.

The first suggestion that squirter might be of parastic origin came from Dr. D. A. Herbert[2] who in 1931 noted the presence of a fungus in affected fruit and later isolated this and determined it to be a species of *Nigrospora*. In 1933 McLennan and Hoette[8] in Melbourne and Simmonds[9] in Brisbane published the results of independent investigations which proved conclusively that the squirter rot was the result of infection by a parasitic fungus. The causal organism was referred to a new species of *Nigrospora*, *N. musae*, by the former authors and to *N. sphaerica* by the latter. Hoette[4] demonstrated later that the same organism was also responsible for a considerable proportion of the black end occurring during the winter and spring months.

As a result of this work it was shown that the internal nature of the rot is due to the manner of infection. The organism enters one or more vascular strands at the broken stalk end and travels down these without lateral extension until the ovular region is reached. The *Nigrospora* was found to be present in the plantation on dead banana tissue such as leaves, petioles, and bracts, and also on banana debris in and around the packing shed. The fungus has also been recorded on several of the common grasses found in the vicinity of the plantation as well as on sugar cane, rice, and maize. In the case of the last mentioned the organism exists in a pathogenic capacity, causing a dry rot of the ear.

Several aspects of the squirter problem were still in a doubtful position after the publication of the two papers mentioned. There was, firstly, the question of the correct nomenclature of the causal organism. Although this is a somewhat academic point it does have a practical bearing in that it is necessary to distinguish between parasitic and non-parasitic forms of *Nigrospora* when investigating all sources of spore contamination. Secondly, the contributing effect of chilling, although a recognised fact, could not be adequately explained. Lastly, and most important of all, the practical control of the disease was not in a much better position after than before the cause was known. The obvious suggestions regarding sanitation, although no doubt helpful, did not result in a definite control of the disease.

During the latter part of 1934 and the years 1935 and 1936 the junior author was seconded by the Council for Scientific and Industrial Research to the Department of Agriculture and Stock, Queensland, to assist in the investigation of banana transport diseases. This was made possible by the Commonwealth grant towards the development of scientific research in the banana industry. Although most attention was paid to black end and anthracnose, some work having an important bearing on the control of squirter was also carried out and it is chiefly with this that the present paper seeks to deal.

Following on the work reported in the paper already cited, Hoette[5] carried out some further investigations in Queensland and New South Wales. These were, by arrangement, mainly of a mycological and physiological nature and have been summarised in an unpublished report to the Council for Scientific and Industrial Research to which the authors have kindly been give access. Reference is made to this report in connection with matters of relevant interest.

Early Investigations Bearing on Control.

As long as squirter was considered to be of physiological origin it was difficult to arrive at a fully effective means for controlling the disease. Certain practical suggestions were based on the knowledge that cold temperatures were a contributing factor. These received support from the work of Young, Bagster, Hicks, and Huelin[10], who showed that chilling on the plantation or during transport was detrimental to the proper ripening of the banana and was definitely conducive to squirter development. The chance of fruit being subjected to excessively cold temperatures while in transport although not great is now minimised during the winter months by sheeting the railway trucks and insulating the fruit in the case by packing with a complete lining of paper. Hicks and Holmes[3] showed that the risk of chilling in the plantation is more serious and it is a recommendation that, during cold weather, the fruit should be picked during the warmer part of the day and should be covered and protected from the cold as much as possible until placed in the van.

Young[10] and his co-workers quote an experiment in which it was shown that considerably less squirter developed in fruit packed in hands and part hands than in singles, facts which are easily explained now that the parasitic origin of the disease is known. These results were later confirmed by Hoette[5] and the authors. It was shown by the former who used artificially inoculated fruit that the greatest reduction is obtained when the fruit are packed in full hands with an appreciable amount of cushion left attached. The amount of squirter developing in a part hand pack is usually definitely less than in the case of singles, but is of a somewhat variable order. Packing in hands and part hands avoids a certain amount of injury through bending and splitting of the stalk, which may not be entirely eliminated even when the utmost care is exercised when breaking into singles. This method therefore also has the advantage that there is less loss from the development of black end. The full hand pack has a number of disadvantages from the commercial point of view. The part hand pack is preferable as it has these drawbacks to a considerably less extent. However, the adoption of the part hand pack, while bringing about an appreciable reduction in losses, is not a sufficiently reliable or efficient method of control to be regarded as a satisfactory solution of the squirter problem.

With the knowledge that squirter was caused by infection by the spores of a parasitic fungus, it was natural to suggest sanitation measures. It has been shown by Simmonds[9] and later confirmed by Hoette[5] that the source of infection lies in the *Nigrospora* associated with banana trash, old fruit stalks and other debris in and around the packing shed and even more particularly with dead leaf stalks, dead areas of leaf tissue, and the bunch bracts and spathe in the plantation. The exposure of plates of culture media in the packing shed and plantation has shown that the spores are commonly wind borne.

Although fresh infection is possible in the packing shed, examination of fruit before harvesting and immediately on arrival at the shed shows that they are, in many cases, already plentifully scattered with

Nigrospora spores, and it is accordingly considered that the plantation is the most important source of contamination. During the operation of breaking into singles and packing the organism is enabled to reach the freshly exposed surface of the fruit stalk and bring about infection. Cleanliness in the packing shed, coupled with periodic spraying thereof with 5 per cent. formalin solution, will tend to reduce the amount of infection taking place at the shed, but will not account for those spores which are present on the fruit when it arrives there. The authors conducted an experiment to see whether the careful removal of all dead leaf material and bracts from a block of plants, in conjunction with spraying the packing shed with formalin, would reduce squirter losses. No essential difference was noted in the distribution of squirter in fruit from this and the control block. Possibly had the treatment been carried out over the entire plantation for a longer period at frequent intervals instead of only the once, better results might have been forthcoming.

Control by a Fungicidal Treatment of the Fruit.

It is obvious that all the measures so far described, although contributing to a reduction in the amount of squirter developing, can not be relied upon to eliminate it entirely and even a small percentage of affected fruit is sufficient to prejudice southern buyers. To attain the desired end, it appeared necessary to develop a method of sterilizing the surface of the fruit immediately prior to packing. As pointed out by Simmonds[9] a treatment at this time is not impracticable provided a suitable fungicide is available. Both Hoette[5] and the authors showed that dilute solutions of formalin as well as certain other fungicides would prevent the germination of *Nigrospora* spores and carried out preliminary field tests which were, however, inconclusive. Attention later became focussed on developing a fungicide for the control of black end and anthracnose and as these diseases were easier to work with than squirter the control of the latter was left in abeyance for the time, it being considered that a treatment effective for *Gloeosporium musarum* would be equally so for *Nigrospora*.

For the control of black end and anthracnose vapour and liquid treatments were tried. Formaldehyde gas, sulphur dioxide and several other vapours were used, but these either failed to give control or when used at an effective concentration resulted in severe injury to the fruit. Wet treatments included formalin at various strengths, Shirlan, malachite green, sodium benzoate, copper sulphate, and borax. In most cases laboratory experiments with inoculated fruit and field tests were carried out. A solution of formalin at ·25 per cent. and 1 per cent. strength used as a dip reduced the amount of black end somewhat and caused only slight injury to the fruit. Shirlan A.G. and XP18 at ·75 per cent. concentration and over gave somewhat better control, and caused no injury. No appreciable deposit was left at concentrations of less than 3 per cent. Borax used at 4 per cent and 8 per cent. in water at 50 deg. and 54 deg C. gave good control of anthracnose and a control of black end similar to that of formalin, but the necessity for maintaining a constant temperature and other disadvantages make the use of this material uneconomic. It was very noticeable that the control exerted by Shirlan when a large proportion of the black end was due to *Nigrospora* infection was much greater than when *G. musarum* was the chief causal agent. This is illustrated in Table I.

TABLE I.

THE DIFFERENCE IN THE EFFECT OF SHIRLAN ON BLACK END WHEN DUE TO INFECTION BY (1) *Nigrospora* AND (2) *Gloeosporium musarum.*

Treatment.	Organism mainly responsible.	Percentage of severe Black End.	Number of fruit.
Dipped 1·0 per cent. Shirlan A.G. ..	*Nigrospora*	0·3	398
Untreated	..	48·6	372
Dipped 1·5 per cent. Shirlan A.G. ..	*Gloeosporium* ..	3·3	155
Untreated	..	9·8	165
Dipped 3·0 per cent. Shirlan A.G. ..	*Nigrospora* ..	8·2	447
Untreated	..	61·9	540
Dipped 3·0 per cent. Shirlan A.G. ..	*Gloeosporium* ..	4·1	171
Untreated	..	14·3	134

Since none of the fungicides used could be claimed as an unqualified success so far as black end and anthracnose were concerned it became necessary to take up the matter with special reference to squirter. Some difficulty was experienced in obtaining satisfactory and uniform infection with the disease. In the latter part of 1936, however, a plantation from which it was possible to obtain heavy natural infection with squirter came under notice and results of a conclusive nature were obtained from field experiments carried out there. As Shirlan had given best results in the control of black end this fungicide was used at first and the success was so marked that all future work was concentrated on how the Shirlan could be put to best advantage. Formalin was known to inhibit germination of the spores and Hoette[5] had obtained an indication that it might be useful as a fruit treatment, but the disadvantages in that there is danger of serious skin injury with solutions stronger than 1 per cent. and that reinfection is possible once the solution has evaporated are such that this disinfectant was not further investigated.

Fruit for the field experiments was obtained at the plantation in the bunch, brought to the packing shed and there cut and treated immediately. Comparable lots of fruit were obtained by dividing each hand into two or three approximately equal parts, depending on the number of lots required. The fruit were broken into part hands or singles as the case might be, immersed in the suspension of Shirlan for just sufficiently long to ensure thorough wetting, and then drained and packed. They were ripened as slowly as possible in the rooms of the Committee of Direction of Fruit Marketing by subjecting them to the lowest temperature available at the time.

In the original experiments, when Shirlan XP18 was used, only the fruit which felt soft at or near the end was examined internally. In subsequent trials all the fruits were cut longitudinally to ensure that no affected ones were overlooked. Throughout these experiments all doubtful and some definite infections were tested by making tissue plantings from the flesh to potato dextrose agar. Particular attention in this respect was given to treated fruit. The small number of doubtful cases which gave growth to *Nigrospora* were classified accordingly.

In Table II. are given the results obtained by the use of three forms of Shirlan at different strengths. All the experiments listed were field trials, and in each case the fruit was broken into singles for packing. Shirlan A.G. is the commercial article on the market in Queensland. It consists of a 25 per cent. suspension of salicylanilide in water together with a wetting and spreading agent. Shirlan W.S. is the water soluble sodium salt of salicylanilide while Shirlan XP18 has copper in combination. Neither of these two appeared to possess any advantage over Shirlan A.G.

TABLE II.

THE RESULTS OF TREATING BANANA FRUIT WITH SHIRLAN FOR SQUIRTER CONTROL.

Fungicide.	Method of Dipping.	Per Cent. Squirter.		No. of Fruit.	
		Treated.	Untreated.	Treated.	Untreated.
Shirlan XP18 3 per cent.	Singles	0	1·0	88	199
Ditto	Hands	0		95	
Ditto	Singles	0	1·1	186	190
Ditto	Singles	0	5·6	136	142
Shirlan XP18 1 per cent.	Singles	0	12·2	79	80
Shirlan W.S. = 1 per cent. A.G.	Singles	0		82	
Shirlan A.G. 6 per cent.	Singles	0	11·1	221	216
Shirlan A.G. 3 per cent.	Singles (ends only)	0		134	
Ditto	Singles	0		127	
Ditto	One-third hands	1·6	30·2	337	356
Ditto	Singles	0		339	
Shirlan A.G. 1 per cent.	Hands with bunch stalk attached	17·5	17·1	145	192
Ditto	Singles	0		187	
Ditto	One-third hands dipped and dried	0·6	21·7	153	180
Ditto	Singles	0		211	

All fruit represented in this table were packed in singles.

The results show complete control of squirter with all strengths of Shirlan used, when the fruit were dipped in singles. Dipping in one-third hands and then breaking into singles gave a reduction from 21·7 per cent. and 30·2 per cent. in untreated fruit, to 0·6 and 1·6 per cent. for a 1 per cent. and 3 per cent. suspension respectively. This is good commercial control, and it is furthermore considered that, if the fruit were to be dipped in part hands and then packed as such, without further exposure of broken surfaces, the control would approximate to that obtained by dipping in singles. Treatment with the bunch stalk still attached is unsatisfactory. The comparative results obtained for dipping before dehanding, dipping part hands, and dipping the fruit in singles suggest that a protective covering over the cut and broken end is essential for complete control by Shirlan.

A certain amount of blackening and drying of the fruit stalk occurred but, even with 3 per cent. Shirlan, this is not sufficient to be of commercial importance. With concentrations of 3 per cent. and higher a grey powdery residue is left on the fruit. With 1 per cent. this deposit occurs in occasional isolated areas and can be detected only after careful examination.

As a result of these experiments it is firmly considered that a practical and economic method of controlling squirter is now available. Immersion of the fruit as singles (or part hands when packed as such) in a 1 per cent. suspension of Shirlan A.G. is recommended as a routine practice during the winter and early summer months on all plantations where experience suggests losses from squirter are likely to occur. It is worthy of note that this treatment also reduces black end, particularly black end due to *Nigrospora*. Hands should be broken into singles and dipped in the Shirlan mixture as soon as possible after they are removed from the bunch. When a convenient number of fruit have been immersed they can be removed and drained for a few minutes when they are ready for packing.

According to the manufacturers the diluted Shirlan will keep for a considerable period without deterioration. Hence it should be possible to use the same mixture on more than one packing day provided a method of preventing evaporation is available.

Previous recommendations such as the prevention of chilling, sanitation in the plantation and packing shed, and others, still hold good and should be used in conjunction with the dipping. In many cases, where squirter infection is rare, these precautions will be all that is required and the treatment with a fungicide will be unnecessary.

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Contagious Pneumonia in Pigs.

PNEUMONIA is one of the commonest diseases of pigs in this State and is responsible for considerable losses each year. It appears in several forms, having a variety of causes, and may be deal twith as follows:—

1. Pneumonia caused chiefly by a specific germ (*Bacillus suisepticus*).
2. Peumonia caused by pyogenic bacteria (chiefly *Bacillus pyogenes suis*).
3. Parasitic pneumonia caused by infestation of the large round worm of pigs, *Ascaris lumbricoides.*

All forms are most commonly encountered in young pigs in that stage of life between weaning and bacon or porker age.

The varied symptoms, post-mortem appearances, and mortality rate make it possible to differentiate the types with little difficulty.

Swine Plague.

This, caused by *B. suisepticus,* is probably responsible for the majority of outbreaks of pneumonia in young pigs.

Undoubtedly this form of contagious pneumonia has been present in this State for a considerable time, and it would appear to have a wide spread distribution.

The disease may suddenly appear in a herd of pigs without any history of introduction of new pigs or contact with suspected cases.

Infection.

The causal organism may be present in the respiratory tract and alimentary canal of normal pigs, also in the soil, food, and drinking water, so it is obvious that factors other than the mere presence of the organism are necessary for the production of the disease. Thus it is believed that organisms present in the normal animal and ordinarily causing no harm, are spurred to an added virulence by certain conditions of diet and/or general surroundings which also tend to lower the natural resistance of a susceptible animal, with the result that the organism, with its greater disease producing capacity, overcomes the weakened resistance of the animal and the symptoms of swine plague appear.

Keeping in mind the manner in which the disease is produced, it is easy to appreciate the fact that swine plague is more likely to be encountered in piggeries where general management and feeding are far from ideal.

However, swine plague often occurs in piggeries where conditions are excellent, and in such cases it is not infrequently found that the factor responsible for the increased virulence of the organism is dietetic in nature—some sudden change in the routine of feeding or quality of the food.

It must not be overlooked that affected pigs are a danger to others, and when a pig has apparently recovered from the disease it not uncommonly still acts as a "carrier" on account of the continued existence of a small patch of pneumonia in the lung. The contact of young and grown pigs should therefore be avoided.

Symptoms.

These may be per-acute, acute, and chronic in type.

In the per-acute form the pig will suddenly be noticed to be sick, with a high temperature, lying down and having no inclination to move, any such attempt being marked by a staggering involuntary gait. The affected pig may sit on its haunches with head stretched out, breathing being rapid an distressed. Usually death quickly supervenes, occurring 12 to 24 hours after the onset of symptoms, or may sometimes occur without warning symptoms, the animals simply being found dead.

The symptoms of the acute form are those of an active pneumonia, i.e., there is high temperature, little inclination to feed, coughing is marked, and the breathing rapid, panting, and distressed, giving rise to a common name for the disease—"pants"; a sticky discharge from the nostrils, and sometimes from the eyes is common.

Constipation, present in the early stages, is often followed by a blood-flecked diarrhœa, particularly towards the end of the sickness, which lasts 1 to 2 weeks and usually terminates in death.

The chronic form may follow a partial recovery from either of the above forms, or may appear in the herd as the typical form. The general appearance of the animals is altered, pigs becoming sluggish in movement, and the appetite is partially lost, maybe perverted, affected pigs eating all types of foreign material. Coughing is persistent, breathing somewhat laboured, and badly affected animals will assume a position with backs arched and front legs spread wide apart. Sticky discharges are usually present from nostrils and eyes, and a constipated state commonly followed by diarrhœa. Skin eruptions may also be present in the form of red spots, scabs and scales later forming over them. Inflammatory swellings may occur in the joints, leading to stiffness and lameness. The disease runs a course of two to three weeks. Some animals gradually recover, the lameness disappearing, scales peeling off and leaving a healthy skin and the discharges clearing up, but a short, sharp cough usually persists.

It must be realised that the above description of symptoms of per-acute, acute, and chronic forms of Swine Plague refers to typical forms; actually an outbreak of Swine Plague may present all three types, or some combination of these types.

Post Mortem Appearances.

Naturally these vary according to the form the disease has taken.

In the per-acute form the post-mortem changes are not particularly obvious, but on examination the lymphatic glands are found to be swollen and usually darkish-red in colour, and a gelatinous fluid may be pressed from the tissues in the region of the neck and from the swollen (œdematous) lungs.

The commoner acute form shows more typical changes, particularly in the chest cavity, where the lungs are found to be affected with a definite pneumonia, the colour of the lungs varying from dark-reddish to light-grey, and the substance of the affected lung is firmer than a normal lung. An extensively affected lung will not float in water. An excessive amount of fluid may be found in the chest cavity and in the sac surrounding the heart, and affected areas of the lungs will be seen to adhere to the chest wall by fibrous strands and patches.

Lymphatic glands of the chest may be swollen and slightly hæmorrhagic, while the mucous membrane of the stomach and intestines often shows inflammatory changes varying from slight congestion to more intense congestion with occasional hæmorrhagic areas.

The changes observed on post-mortem examination of animals, dead from the chronic form, are mainly confined to the lungs, which, without showing intense changes seen in the acute form, possess areas of somewhat solid consistency, light-greyish-red in colour and smoother in appearance than normal lung. Lung adhesions are marked, the walls of the chest cavity presenting a discoloured roughened and stringy appearance. Reddish-yellow fluid may be noticed in the chest cavity and in the sac surrounding the heart. General lesions of emaciation are present in cases of considerable duration.

Treatment and Control.

Medical treatment is not recommended, greater importance being attached to prevention and control. Preventive vaccination may be carried out, but should never be considered without complete discussion and investigation by the Veterinary Officer.

The practices of inbreeding and intensive feeding are often responsible for the conditions of lowered resistance and greater virulence previously referred to, and such proceedings should therefore be carefully controlled.

Particular care should be paid to the hygienic conditions of the piggery as regards housing and general accommodation. Factors such as exposure to cold, overcrowding in small runs, and unsuitable sheds, and the entire question of feeding, must be investigated. Where a piggery suffers an outbreak of Swine Plague and the owner is quite sure that the best possible conditions of general accommodation prevail, it would be wise to thoroughly check over the question of feeding.

Immediate isolation of all infected pigs is of paramount importance.

In those cases where no improvement is noticed after a couple of days, the wisest procedure is to slaughter affected animals. Even should an infected animal subsequently recover there is the possibility of relapse with reinfection of the piggery.

Steps should be taken to exclude poultry from the piggery, because in the presence of poultry complete isolation of infected pigs is impossible. Certainly where poultry have access to contaminated troughs and yards they are going to spread infection to every yard which they may happen to stain with their droppings.

Thorough disinfection of infected premises with lime is necessary, and where the infection is widespread throughout the piggery it is advisable to consider the establishment of a fresh site.

Pyogenic Pneumonia.

While Swine Plague is probably the commonest type of pneumonia encountered, other forms exist. The chief one of bacterial origin is that caused by *B. pyogenes suis,* the symptoms of which are as follows:—

The first sign of anything wrong may be the onset of nervous symptoms, the commonest being the holding of the head on one side, movement being in circles. The nervous symptoms wholly or partially subside and an acute pneumonia develops, the affected pig being loth to move about, the appetite diminished or absent, and the breathing distressed and very rapid.

The symptoms become progressively worse, the affected pig remains prostrate and death usually supervenes about seven to ten days after the onset of symptoms.

Abscess formation may occasionally be noticed in the region of the hock and knee joints.

Post-mortem appearances are rather typical and small areas of yellowish pus being found in various parts of the body. Muscles, subcutaneous tissues, and lungs contain these purulent foci, which may also be present in lymphatic glands, joints, kidneys, spleen, liver, and bones.

Medicinal treatment is of no use, and if the disease is to be controlled the measures recommended for the control of Swine Plague should be adopted.

Parasitic Pneumonia.

This form of pneumonia is caused by migration through the lungs of immature forms of the large round worm of pigs. It is fairly common in young pigs, but usually does not run the severe course described for the bacterial forms.

Persistent coughing and sluggish development are the commonest manifestations of the condition.

It is found that in the two bacterial forms of pneumonia the number of pigs affected on a property is not excessive, but the majority of affected pigs die. Parasitic pneumonia on the other hand affects a large number of young pigs on a property but deaths are few.

In the event of any piggery becoming affected with sickness resembling the diseases described above, the owner would be well advised to isolate affected animals immediately and communicate with the district Veterinary Officer to establish diagnosis and arrange subsequent methods of control.

PARSNIP GROWING.

Although the parsnip is a native of England and must therefore be classed as a temperate climate vegetable, it may be grown with reasonable success in the tropics during the winter season.

Soil for growing this vegetable should be deep, rich, and free. A good sandy loam gives excellent results. The soil should be prepared some months previously by trenching or cultivating deeply, and incorporating a heavy dressing of stable manure. Organic manures should never be applied in considerable quantities immediately before planting this crop, as they frequently induce forking of the roots. At the end of the wet season the ground should be thoroughly worked up and reduced to a very fine tilth. The seed is then sown thinly and very lightly raked over, after which the soil should be rolled or well packed down with the back of a spade along the drills. The packing is necessary to ensure close contact between the seeds and the soil. A light covering of old horse manure well crumbled, or old sawdust, will assist germination by preventing the caking of the soil.

As soon as the seedlings are well up, thin them out where they are overcrowded and, when about 4 to 6 inches high, thin out finally to about 1 foot apart.

Parsnip seed is usually of rather poor germinating capacity, and is practically useless unless quite fresh.

—*S. E. Stephens.*

The PIG FARM

Hints for Pig Exhibitors.

E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

THE desire of every stud stock breeder is to develop animals that will win awards in the best of company. The following points are suggested for the consideration of show exhibitors:—

Selection.

The possibility of securing premier honours, while depending very largely on bodily conformation, colour markings and freedom from faults, depends also on the time the exhibitor is willing to give to the preparation of his stock and the businesslike attitude he adopts towards the job. He will learn by experience that there are times when a few extra minutes spent, and additional care, may mean the difference between a champion, a first, a second, or even a third prize. Successful exhibitors spare no effort to do everything possible to have their stock ready at the time of judging.

Some animals are more readily handled than others, some are good feeders, some are intelligent, while others are good but stubborn. Some feed well in familiar surroundings, but when placed in the show pens in a strange environment become restless and disgruntled, refuse to eat, and rapidly lose bloom, thus spoiling the exhibitor's chance in competition.

In selection, nothing but the best should be penned. It is useless filling up show pens with second-grade animals. The size and importance of the show, and the competition, must of course be taken into consideration. To win a championship at a small country show is quite different from winning premier awards at a show like the Royal National, Brisbane, or the Royals at Sydney and Melbourne.

The exhibitor should study carefully the prize schedule long before the show at which he proposes to exhibit, and should aim at having his animals entered in classes for which they are most suited. A class for boar over nine months and under twelve months is more readily won, other things being equal, with a boar twelve months' old than with one at nine months old. The prize for sows with litter not more than ten weeks of age is more frequently won with a really good sow with a litter ten weeks of age, than with a really good sow and a litter ten days old.

Size for age is also important. In a class for sow twelve months of age the sow should be fairly forward in her gestation period; a sow not in pig does not or should not stand the same chance of winning.

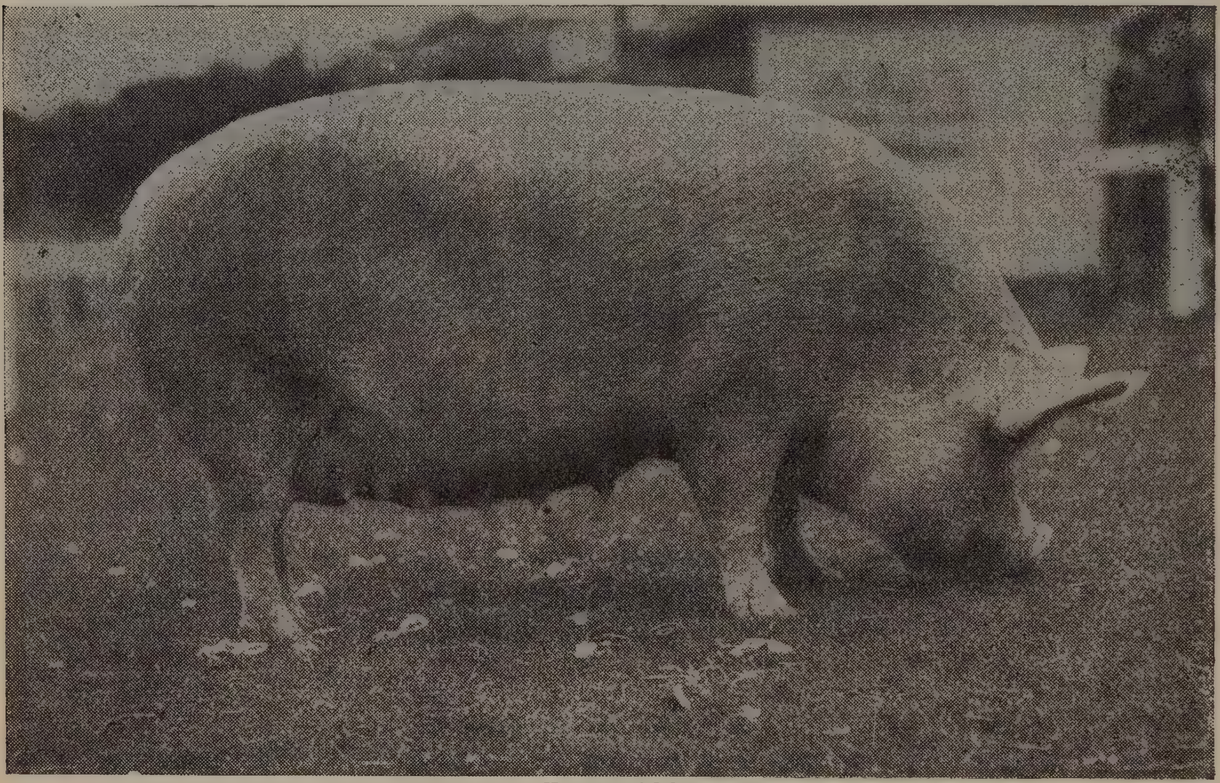


Plate 180.

Typical Large White Sow showing long sides and back, deep roomy body, well-developed udders and teats, and other desirable feminine characteristics.

Animals with manifest faults should never be exhibited. A boar with only one testicle showing, or a sow with several blind or dummy teats, should be rigorously excluded. A pig with a long, unmanageable tongue, which protrudes several inches from the mouth, should not be shown, nor should pigs that are mismarked or otherwise faulty.

Condition.

Breeding stock should be shown in good breeding condition only: any tendency to excessive fatness should be avoided. If breeding stock over twelve months of age are any good as breeders, and are shown in profitable condition, they will not be overfat. Similarly, animals in low condition are undesirable: even a sow with a large litter should be in good condition, otherwise she will not show to advantage.

Commercial stock should be shown in medium condition only, for there is no demand for very fat meat, and the judge is at fault who recognises and places overfat animals.

All pigs shown should be absolutely free from parasites—body lice, fleas, or worms. Animals with a vicious temperament should be excluded, and should not be kept on the farm.

Preparation.

It is unwise to smear the skin and hair with a heavy coat of sticky oil. It is equally unwise to permit the exhibition of pigs without first thoroughly washing and cleansing the skin and hair. Regular washing with warm water and soft soap should be the rule for several weeks before the date of showing. The exhibitor who pens pigs bespattered with mud and in a dirty condition, only exposes himself to criticism. Careful washing and grooming, and a light brushing over with a brush or cloth, using colourless oil, is advised, and especially immediately before parading. Regular oiling will assist in keeping the animals free of parasites, and in mellowing the skin and hair, with obvious advantages.

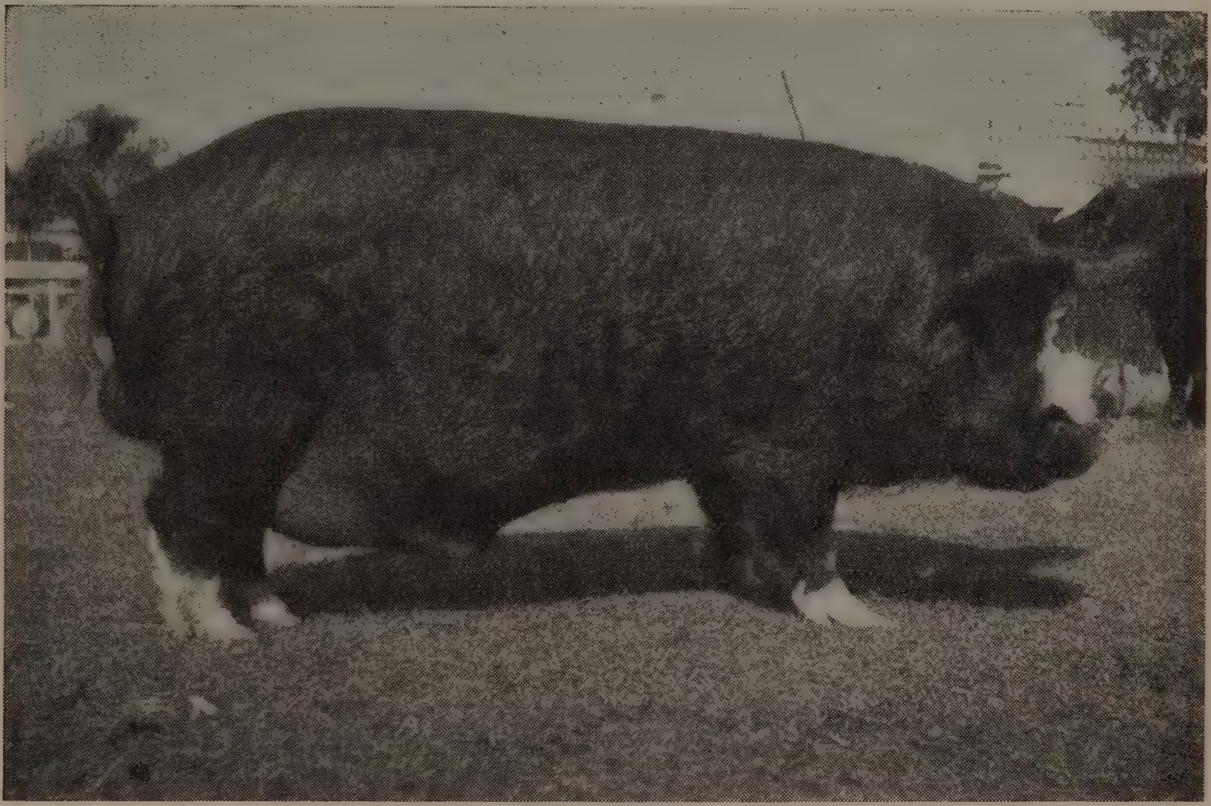


Plate 181.

Typical Berkshire Boar, a prominent prize winner at Queensland shows. Note great depth of body, strong masculine characteristics, and correct colour markings.

In the exhibition of stud pigs, clipping of the hair is always objected to as it is not actually necessary, and any attempt to clip with a view to removing natural markings is an offence.

Animals should be carefully trained to parade properly, and to stand at ease before the judge. The anxious, excitable animal—who also is in charge of an excitable exhibitor—usually fares badly, whereas the well-trained animal in the hands of a patient, observant exhibitor, is more likely to succeed.

Judging Rings.

It is, of course, essential to parade all mature animals before the judge, for it is quite impossible to judge mature stock satisfactorily while they are penned in small enclosures. Judging rings are best where they can be arranged for, provided that the animals are well-trained, and that exhibitors are prepared to devote time to the job.

Feeding.

Regular exercise is essential to the successful exhibition of pigs, and plenty of green food, and clean drinking water should be provided. Purgative methods should not be employed, nor should foods of a very laxative nature be used.

The animal should not be overfed, nor should stale, sour, or high-smelling food be used. The food troughs should be scrupulously clean. Feed should be given strictly at regular intervals, and, most important of all, the same class of feeding stuff should be used for several days before taking the pig to the show, so that it may become accustomed to any change of food. If an animal refuses to eat, and appears to be losing bloom, a slice or two of apple or carrot, a piece of pumpkin, or some such tasty morsel—especially if sprinkled with salt—will often bring the animal back to its food. In fact a very light sprinkling of salt over the food followed by clean drinking water will be found useful for show pigs. Clean, dry straw, and plenty of it, is advisable for bedding down, and will make the animal feel more at ease. Sawdust, shavings, corn husks, or leaves are not advised if it is possible to substitute straw. The pens must be kept clean, and soiled bedding and dung must be removed regularly every two or three hours.

General.

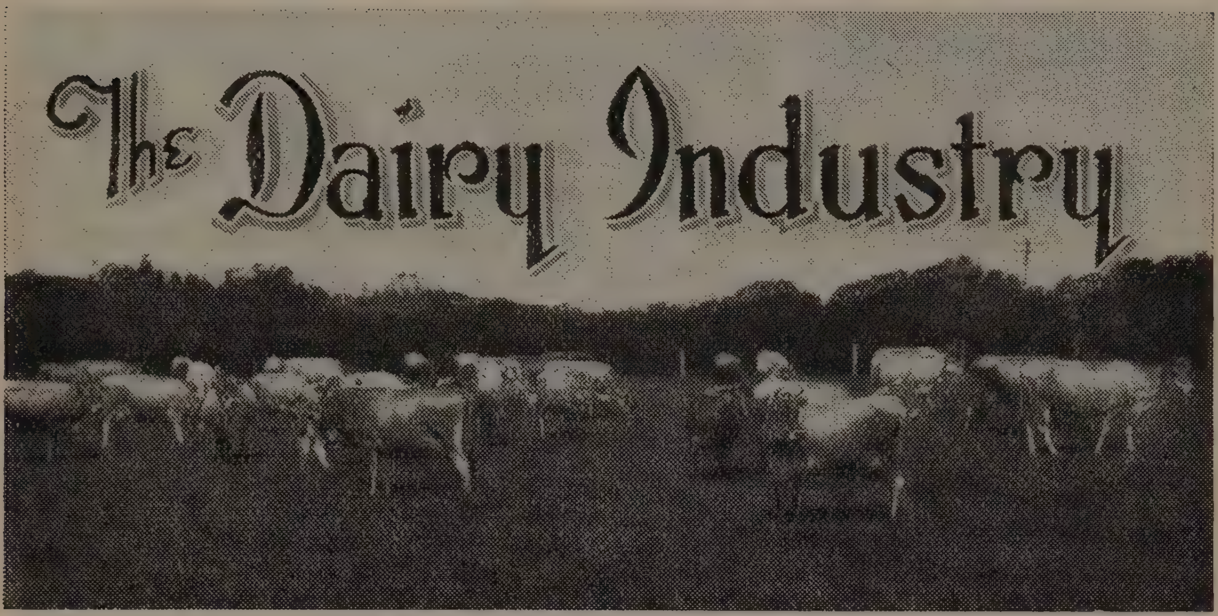
It is unnecessary for the exhibitor to appear before the judge in ''pig pen togs''; he should be just as spic and span as the animal. A combination of both, added to a pleasant, courteous manner, and a smile even under difficult circumstances, does much to create confidence. The exhibitor should watch the animal during judging; but should not watch the judge, except to receive instructions. When the judge has finished with an animal, its owner should not worry other exhibitors, who are just as keenly interested in their own exhibits, as he is in his. The judge has a difficult task, and he appreciates the co-operation of exhibitors in placing the animals before him. Exhibitors should not try to influence the judge; but should be ready at any time to answer any questions the steward might ask. When judging is completed, the exhibitor should await a favourable opportunity for having a chat to the judge about the exhibits. Shows are educational, and are for the purpose of providing comparisons. Exhibitors are, of course, entitled to their own opinions just as much as the judge.

Agricultural societies are always glad to have suggestions from exhibitors. Every exhibitor is, or should be, a show official, and as such should have some influence on the success or otherwise of the show. Exhibitors have the privilege of sending in nomination of judges for consideration by the show society.

It is well to remember that it is only fair to other exhibitors of pure bred stock that the stud pigs of others should be registered in the appropriate herd book, or be eligible for registration. The Australian Stud Pig Breeders' Society provides for registration. It is wise also to have printed pedigree forms for stud pigs, and it is important to have the pedigrees prepared in readiness, so that when an animal is sold, the pedigree may be handed over with the receipt. Delay in the issuing and forwarding of pedigrees, and the incorrect preparation of pedigrees which are lacking in detail, cause trouble, confusion, and unnecessary inconvenience to the buyer.

Judicious advertising should not be neglected. The Stud Pig Breeders' Society will advise any breeder interested as to the prices he or she should ask for pedigree male or female animals.

Full particulars about the size of crates, material to be used, method of construction, and other relevant information, may be obtained free of cost from the Department of Agriculture and Stock. Crates should be returned promptly if required and in as good a condition as when received.



Estimation of Acidity in Milk, Cream and Whey.

L. A. BURGESS, A.A.C.I., Dairy Research Laboratory.

THE regulations under the Dairy Produce Acts specify that no milk containing more than 0·25 per cent., nor cream containing more than 0·67 per cent. of acidity shall be classified as first-grade quality. The development of acidity in milk and whey is all important in cheesemaking and accurate control of cream acidity plays a very large part in the manufacture of a good quality butter.

For these reasons it is essential that accurate acidity tests be performed at all times. Attention to details and a knowledge of the principles involved in the estimation are as necessary to the factory operative as they are to the analyst.

Reagents.

1. *Decinormal sodium hydroxide,* also known as tenth normal or N/10 alkali.
2. *Phenolphthalein* indicator solution.

Apparatus.

1. *Burette,* graduated in 0.1 ml. divisions.
2. *Burette stand* and *clamp,*
3. *Pipette,* may be of any desired capacity. Usually a 9 ml., 10 ml., 17·6 ml., or 20 ml. pipette is used.
4. *Titration vessel.*
5. *Glass stirring rod.*

Determination.

(a) *Milk and Whey.*—By means of the pipette measure out a known volume of milk or whey, wiping the outside of the pipette *before* adjusting the bottom of the meniscus to the graduation mark.

Transfer to the titration vessel. Add 5 to 10 drops of phenolphthalein solution. From the burette run in the decinormal sodium hydroxide solution drop by drop stirring the contents of the vessel constantly. Stop when the first tinge of pink colour appears. Read off the volume of decinormal alkali solution used.

$$\text{Percentage of acidity} = \frac{\text{ml. of N/10 alkali used} \times 0{\cdot}009 \times 100}{\text{quantity of sample taken.}}$$

(b) *Cream.*—By means of the pipette measure a known volume of cream, wiping the outside of the pipette *before* adjusting the bottom of the meniscus to the graduation mark.

Transfer to the titration vessel. Rinse out the pipette with warm distilled or rain water by filling to approximately the position of the graduation mark and add the rinsings to the contents of the titration vessel. Add five to ten drops of phenolphthalein solution and proceed as directed for milk and whey.

Acidity.

When milk is freshly drawn from the udder it has an acidity ranging from 0·1 to 0·2 per cent., in some cases even higher, the average being about 0·17 per cent.

This initial acidity is due to acid salts, casein, and dissolved carbon dioxide. On exposure to the air some of the carbon dioxide escapes and the acidity drops a little. It soon begins to rise again owing to the action of bacteria which act upon the lactose, forming lactic acid. There are thus two forms of acidity in milk, the initial acidity due to normal milk constituents and that due to lactic acid.

As it is difficult to differentiate between the lactic acid and other acidity, the whole acidity is for convenience calculated and reported as percentage of lactic acid.

Principle of the Test.

When an acid is mixed with an alkali a chemical reaction occurs with the formation of a neutral substance, termed a salt, and water. This reaction is known as neutralization. Thus when lactic acid and sodium hydroxide react, neutralization occurs with the formation of sodium lactate and water.

$$\underset{\text{Lactic acid}}{C_3H_6O_3} + \underset{\text{Sodium hydroxide}}{NaOH} \longrightarrow \underset{\text{Sodium lactate}}{C_3H_5O_3Na} + \underset{\text{Water}}{H_2O}.$$

As this is a reaction between definite chemical compounds, it is a comparatively simple matter to estimate the percentage of lactic acid when a known amount of milk or cream is initially taken and neutralized with a sodium hydroxide solution of known strength. The neutralization must not be overdone, however, and a substance known as an indicator is used to show when the neutralization is complete. Indicators are substances which display a marked colour change in acid and alkaline solutions. Phenolphthalein, for example, is colourless when acid and red when alkaline, and has been found to be the most suitable indicator for the particular purpose under discussion.

Calculation of Percentage.

From the equation shown above it has been calculated that ninety parts by weight of lactic acid will be neutralized by forty parts by weight of sodium hydroxide. The decinormal sodium hydroxide is made to a definite strength and contains 4 grams per litre. Thus 1 ml. (one thousandth of a litre) contains 0·004 gram of sodium hydroxide. It is just a matter of simple proportion to determine that 1 ml. of decinormal sodium hydroxide solution will neutralize 0·009 gram of lactic acid.

When a known quantity of milk or cream is taken and the acidity is neutralized by a determined volume of decinormal sodium hydroxide, the percentage of acidity may thus be determined :—

$$\text{Acidity percentage} = \frac{\text{ml. of N/10 alkali used x 0·009 x 100}}{\text{quantity of milk or cream used}}$$

This equation may be used when any known quantity of milk or cream is taken. Applying it to the widely used 9 ml. pipette the equation becomes

$${}^{*}\text{Acidity percentage} = \frac{\text{ml. of N/10 alkali used x 0·009 x 100}}{9}$$

$$= \frac{\text{ml. of N/10 alkali used}}{10}$$

* Strictly speaking this only gives the percentage by volume, i.e., 100 volumes of milk or cream contain so many parts by weight of lactic acid. The figure so obtained is, however, close enough for most practical purposes.

When any other volume of milk or cream is taken the full equation must be used.

Precautions to be Observed.

1. *The sample taken for examination must be representative of the bulk.*—This is so obvious that a detailed discussion is unnecessary. Care must therefore be taken to thoroughly mix the contents of the vat or other container, then take a number of small samples from different places, and thoroughly mix these small samples together.

2. *Location of Equipment.*—The tests should be performed in a well lighted position but not in direct sunlight. It should, of course, be close to the neutralizing vats in a butter factory and to the cheese vats in a cheese factory. It has sometimes been noticed that the equipment is located in a small cupboard or dark corner of a factory where accurate tests are impossible. It is such an essential part of factory routine that provision should be made for this equipment when the factory is being designed.

3. *Accuracy of the graduated glassware.*—There are now included in the Dairy Produce Acts specifications for 9 ml. pipettes used for acidity tests. Such pipettes must be submitted to the Department of Agriculture and Stock for approval. Burettes have been noticed in factories which have been found to be inaccurate. Although no definite specifications for burettes have been made, as designs and sizes vary considerably, butter and cheese factories should, for their own protection, demand that their supply houses submit burettes to the Department for approval.

4. *The Titration Vessel.*—The ideal titration vessel is a shallow white cup or basin with translucent walls. This is hardly necessary for ordinary work for which a shallow wide-mouthed cup will be found satisfactory. A metal vessel, such as is used in butter factories for collecting cream samples, is very unsatisfactory and should never be used.

5. *The water added when testing cream.*—The water used to rinse out the pipette when cream is being tested should be neutral in reaction—i.e., it should be perfectly colourless when phenolphthalein is added to it, yet should turn pink when one drop of N/10 alkali is added to 9 ml. of water. There are a number of factories using bore or well waters which contain considerable quantities of sodium carbonate in solution. Such waters are alkaline and will neutralize at least a portion of the acidity. One case has been noticed where 9 ml. of water was responsible for neutralizing 0·09 per cent. of acidity when 9 ml. of cream was used. The acidity tests in that particular factory would therefore be about 0·09 per cent. lower than the true percentage. In another case the water was distinctly acid, due to a clarification process, and tests using this water were higher than the true percentage. Water for the acidity test should not be taken from the hot water vessel used for the Babcock Test as this may be distinctly acid. A vessel recently washed with an alkaline cleanser may be responsible for considerable alkali being added with the water. If possible, distilled water (condensed steam), or rain water should be used.

6. *Accuracy of the decinormal sodium hydroxide.*—Most factories purchase their supply of decinormal sodium hydroxide solution from supply houses.

If kept in stock for too long a period a flaky sediment is formed by the action of the alkali on the glass. This may be very largely prevented by manufacturers coating the inside of the bottles with hard paraffin wax which is unaffected by alkali.

As usually prepared, the required weight of sodium hydroxide is weighed out, dissolved in the required volume of water, and the solution is then tested and corrected. This is somewhat unsatisfactory as even the purest sodium hydroxide may contain up to 2 per cent. of sodium carbonate. This has the effect of causing the pink colour to appear and then fade rapidly although the total alkalinity may be correctly decinormal. A more satisfactory method of preparation is described later.

If the alkali solution is exposed to the air for any length of time, either by removing the stopper or allowing to stand in the burette, carbon dioxide is absorbed from the air forming sodium carbonate. Care should therefore be taken to keep the stock bottle well corked, and discard the alkali remaining in the burette after the final titration for the day.

7. *Depth of pink colour.*—The depth of colour developed during the titration has been noticed to vary considerably, depending apparently on the person performing the test. This may be due to inability on the part of the operator to detect the first tinge of pink, an insufficiency of phenolphthalein solution, carelessness, or ignorance of what is required. Some firms supply glass stirring rods in which are enclosed pink paper and the titration is supposed to proceed until the pink colour in the milk or cream matches that of the paper. This is not always successful as some milks and creams normally have a rich yellow colour and the first change of colour noticeable is more orange than pink. Probably the most satisfactory method is to have a second cup in which is placed 9 ml. of the particular milk being tested, or 9 ml. of the particular cream and 9 ml. of water, alongside the operator. By comparison the first change of colour is easily noticed.

As the pink colour only develops slowly it is necessary to have sufficient phenolphthalein present to give a distinct pink with one or two drops of excess alkali. At least 5 drops of a 1 per cent. phenolpthalein solution should be added and the same quantity should be used for each test.

8. *Effect of carbon dioxide.*—Carbon dioxide, which is also known as carbonic acid gas, seriously affects the acidity test.

When carbon dioxide is present it combines with the sodium hydroxide and forms sodium bicarbonate and sodium carbonate. As the former compound decolourises phenolphthalein, erroneous results are obtained. When fermented or gassy creams are being tested the error may be as high as 0·07 per cent., or even higher.

After cream is neutralized it is passed over the pasteuriser and the heating to which it is subjected liberates most of the carbon dioxide. If pasteurisation is followed by, or is simultaneous with, a vacuum treatment, it is probable that all carbon dioxide is liberated. It is because pasteurised cream thus contains less carbon dioxide than raw creams that the acidity following pasteurisation is generally lower than that desired. If very accurate acidity tests are desired for cream, the 9 ml. of cream and rinsings should be gently boiled for about 30 seconds. Having thus liberated the carbon dioxide the cream should be cooled and titrated as usual.

Preparation of Decinormal Sodium Hydroxide.

For those factories which have the services of a chemist available, the following method of preparation is strongly recommended. Dissolve one pound of the purest sodium hydroxide obtainable, preferably of ''AnalaR'' or ''Guaranteed Reagent'' quality, in one pound (450 ml.) of distilled water. This solution is to be allowed to stand for some days in a resistance glass vessel, or in a bottle internally coated with hard paraffin wax, securely stoppered with a rubber cork or waxed bark cork. After a few days the sodium carbonate, which is practically insoluble in such a strong solution of sodium hydroxide, will have settled to the bottom leaving the supernatant liquid clear. This clear liquor, which contains about 50 per cent. by weight of caustic soda, has a specific gravity of about 1·53, and can be siphoned off into another similar container for storage purposes. This solution is of such strength that only from 5·5 to 6 ml. is required for each litre or decinormal solution required.

When diluting this strong solution preparatory to standardising, the distilled water should be boiled and cooled just prior to use. This is to free it from carbon dioxide which it absorbs from the air. Rain water may be used, but other waters are unsuitable. The diluted solution should be made slightly stronger than decinormal, as it is far easier to dilute the solution than to add a small amount of strong alkali during the subsequent adjustment.

A known volume of a standard acid solution (N/10 or N/5) is pipetted into a titration flask, one or two drops of phenolphthalein solution added, and then titrated with the approximately N/10 alkali until the pink colour remains for some twenty or thirty seconds. (It will eventually disappear by the solution absorbing carbon dioxide from the air.) The required volume of water to be added may then be calculated as follows:—

Twenty ml. of standard N/10 acid (or 10 ml. of standard N/5 acid) required 19·1 ml. of the approximately N/10 alkali solution. If the alkali were accurately N/10 it would have required 20 ml. exactly. Say that there is 9,900 ml. of alkali solution left after the intial test. The amount of water to be added is then—

$$\frac{(20{\cdot}0 - 19{\cdot}1) \times 9{,}900}{19{\cdot}1} = \frac{0{\cdot}9 \times 9{,}900}{19{\cdot}1} = 466 \text{ ml.}$$

As a precautionary measure only 450 ml. of water should be added and the solution tested as before. When the solution is accurately adjusted at least two titrations should be made to confirm the standardization.

The solution should then be stored in tightly-corked resistance glass bottles or waxed bottles, labelled, with the date and the name of the person who performed the standardization.

Preparation of Phenolphthalein Solution.

The indicator solution is prepared by dissolving 1 gram of phenolphthalein power in 100 ml. of 90 per cent. alcohol. The alcohol need not be that known as rectified spirit, methylated alcohol, or denatured alcohol being quite satisfactory. Methylated spirits, however, should not be used for the purpose.

THE AGE OF A COW AND ITS EFFECT ON MILK.

How does the age of a cow influence the composition of its milk? This is a question often asked. From the dairyman's point of view the fat is the most important constituent, and much experimental work has been carried out to determine how the fat test varies with the age of the cow. It has been shown that, with advancing years, cows produce milk containing a diminishing percentage of fat. The variation observed is not of any serious consequence, but it is nevertheless noticeable when average figures are taken. A cow of a high testing breed, which shows an average test of 5 per cent. of fat as a young animal, will decline to about 4.5 per cent. if she continues to produce to fourteen years of age.

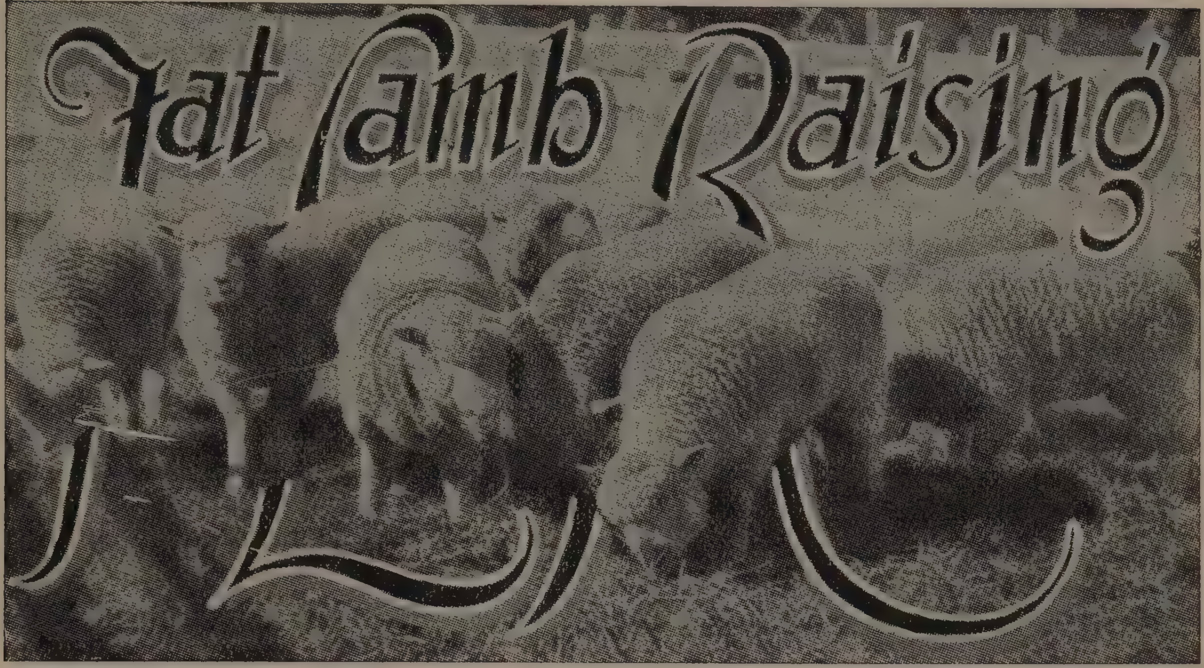
It is sometimes thought that a heifer showing a low test as a two-year-old may improve as she matures. There are no grounds for such a belief, and any farmer building up hopes of this nature is likely to be very disappointed. The richness of milk is a matter of inheritance, and so far as is known nothing can be done to change it in an individual animal.

An interesting feature with this work is that mathematicians have taken an interest in it, and one man has actually worked out a formula for calculating the fat test for any specified age, provided that the average test for the first milking period is known.

The effect of age on the other constituents of milk has also been studied and there is a decrease, with age, in all constituents except albumen, which increases slightly from year to year.

The effect of age on the fat test (richness) of milk should not be confused with the effect of age on milk production. There is a gradual increase in the quantity of milk produced from year to year until a maximum period is reached, after which the production figures show a slow decline. The age of maximum milk production for most breeds has been shown to be eight or nine years.

—O. St. J. Kent.



Fat Lambs in Queensland.

J. L. HODGE, Instructor in Sheep and Wool.*

QUEENSLAND can produce fat lambs as good in quality as any of her sister States or New Zealand. It is safe to say that there is no quicker money to be made out of sheep than in the production of the right type of sucker lamb. Prices during the past three years have been exceptionally good, and at the present time compare more than favourably with values elsewhere. The Department of Agriculture and Stock has more or less concentrated on fat lamb raising during the past few years, and the results have been highly gratifying. At the same time the opportunity exists for the profitable production of a great increase in numbers to the direct benefit of the farmer and the State generally.

The scarcity of the right type of crossbred ewe is one of the difficulties with which the industry is at present faced. So much is this the case that for the present the crossbred ewe may be disregarded and the presumption that a start has to be made with the merino ewe taken for granted. The best ewe for the production of fat lambs is got by the introduction of the long wools, such as Border Leicester, Romney Marsh, or Lincoln rams with the most robust strong woolled merino ewes. The ewe portion of the resultant drop should be retained as the breeding flock.

If one is fortunate enough to be able to purchase Corriedale ewes so much the better, but these, too, are difficult to come by. Here it may be stated that the few breeders of Corriedales in Queensland are allowing their flocks to become a great deal too fine in the wool. It is a common thing these days to see so-called Corriedales carrying a fleece of merino counts and not strong even at that. This is defeating the object for which the Corriedale was evolved. Properly bred, the Corriedale is an excellent all round farmer's sheep.

Although it is correct to say that in the production of fat lambs the clip from the ewes is of secondary importance, more attention may be given to the fleece with profitable results, provided always that the lambs be regarded as of major importance.

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* In a broadcast talk from Radio Station 4QG (Australian Broadcasting Commission).

A properly bred Corriedale ewe is ideal for the purpose, and in addition the ewe gives a fleece of relatively high value. The Border Leicester-Merino cross also produces a nice fleece of high-yielding wool.

The Romney Marsh with the merino also nicks splendidly. All three crosses mentioned may be highly recommended as the mothers of fat lambs. On any of these crosses (the Corriedale is included for the purpose) a Downs-bred sheep should be used. Opinions naturally differ as to the best of these breeds. There is little doubt that the Southdown is the fashionable lamb at present. He is so shapely and, provided he is adequately fed all the time, he is early maturing. However, it is of importance to remember that the Southdown receives no check. Should this happen he does not compare with some of the other crosses at a more advanced age. Then again the wool from the Southdown may be almost disregarded.

The use of the Dorset horn ram is to be highly recommended. One advantage he possesses over all other breeds is the fact that he will, like the merino, work at any season of the year. All other English-type sheep mate best in the autumn and spring. The Dorset horn produces a particularly nice lamb, hardy and early maturing, and provided they are truly fat they scale well at a very early age. The wool is not high class. The use of the Border Leicester ram is to be recommended, especially when joined with merino ewes. Some buyers prefer the progeny from the merino ewe when the Border Leicester is in question, to the lamb produced from the crossbred ewe. The contention is that the merino ewe throws a lamb of greater refinement than the crossbred ewe to this particular ram. Then again the skin value is greater. For all-round purposes the Border Leicester is hard to beat, and no farmer should regret using him.

It should be the object of the farmer to produce a lamb straight off the ewe and truly fat, weighing 32 to 34 lb. at not more than four months of age. From the teat to the block should be the fat lamb raiser's slogan. To do this with any degree of certainty cultivation is essential. It is a waste of time and money to try and grow fat sucker lambs on natural grasses. Sheep in conjunction with wheat is a splendid proposition, and it is not now a question as to whether the wheat farmer can afford sheep, but rather whether he can afford to be without them. All cereals are to be recommended for the grazing of ewes and lambs. Nothing is better than lucerne, and it is surprising on what lands this highly valuable plant will grow if properly sown and looked after in the early stages of its growth. Provision should be made for winter feeding, and in this connection something definite should be done with regard to permanent improved pastures. Country in the south, which I remember as worth 30s. to £2 per acre, is to-day worth up to £12 and £15 per acre purely as the result of pasture improvement. It is unfortunate that the fencing of a property and its paddocks should be such a comparatively expensive matter where sheep of British breeds and their crosses are depastured.

Nothing less than netting of some sort will hold them, and to mention the worst breed in this connection is only guess work, unless it happens to be the breed the farmer is running. Cultivation paddocks must be securely fenced in order that they may be grazed as required, and the boundary fences must be postively sheep-proof or trouble with neighbours will occur.

A short description of the British breeds used in the production of fat lambs may be of interest.

The Southdown.

The Southdown is a mousy faced, chunky sheep of comparatively great depth and thickness, broad chest, with splendid loins and thighs. As previously explained his progeny require the best of attention with regard to feeding.

The Dorset Horn.

The Dorset horn is a bold fellow with horns placed well forward on the head, differing in this respect from the merino, with well-sprung ribs, broad chest, good loin and thigh. He is of especial value on account of the fact that he will mate at any time of the year. His lambs are hardy and early maturing.

The Border Leicester.

The Border Leicester is a fine upstanding sheep with a noble carriage, plain head and points, showing a nice square effect of body. He is particularly suited to the high lands, produces a neat, early maturing lamb, and crosses particularly well with the merino. The ewe cross Border Leicester-merino is a highly valuable type for the production of fat lambs.

The Romney Marsh.

The Romney Marsh is a sheep of large frame, black nose and preferably feet, carrying a fleece of wool finer and with more refinement than the Lincoln. He, like the Border Leicester, crosses particularly well with the merino, and the ewes got from this cross are regarded as of great value. They are fine milkers. Perhaps the greatest value in the Romney Marsh and his crosses lies in the fact that he is pre-eminently the sheep for over-wet conditions and on lands where other breeds would prove a failure. In the use of the Romney Marsh for the production of fat lambs, I prefer the blood in the ewe. A Downs ram on top of the Romney cross ewe gives a splendid lamb which is thoroughly nourished by the mother.

The Shropshire.

The Shropshire is a sheep with black face and feet, symmetrical in shape, and the producer of a very nice lamb. Where Shropshires are used it is better to market the whole of the drop, as the black is inclined to predominate, and the wool produced by this breed is not regarded with favour. The ewes used in fat lamb raising, whether Corriedale, crossbred as described, or merino, should not be allowed to get too fat before and at mating time. Good strong store condition is all that is necessary. Over-fat ewes are likely to be shy breeders, and this chance cannot be afforded where high-lambing percentages are looked for. In the condition described it is a good plan to flush the ewes on rich and succulent feed a fortnight before joining the rams. Yarding the ewes and rams three or four times a week is to be recommended. The rams, if working, should be left in for a period of six weeks. It is a good plan, if sufficient rams are at the disposal of the farmer, to hold some in reserve and join these in addition to those originally joined about three weeks after the first mating.

As previously intimated, the Dorset horns may be joined with every prospect of a successful mating at any time when the feed is good. All the other British breeds mate best in autumn and spring. Too much importance cannot be attached to the fact that all sires should be pure bred. It is commonly thought that any sires of British type are good enough for fat lamb getters. No greater mistake could be made. One has only to see a crop of lambs got by pure bred sires alongside those from inferior animals to realise the importance of this question of pure sires. The cost of the rams should not enter into the question at all. It is safe to say the pure bred more than pays the additional cost of his purchase in the first crop of lambs. Lambs should be marketed as soon as fit. It is essential in order to achieve top prices that they should appear before buyers with the bloom on them. Too often losses are sustained by growers waiting for the more backward lambs to mature so that a large portion of the drop may be marketed at the one time. In these days of good roads and motor transport, it is an easy matter to land lambs at the yards a few hours after leaving the ewes. That is all to the good.

If conditions are such that lambs have to be driven to the rails, farmers are advised to take a proportion of the ewes with them. It must be remembered that true suckers have never been away from their mothers, and there is a grave risk of knocking the lambs about if the attempt is made to drive them on the roads without some of the older sheep to steady them. Never truck lambs in a heated condition. Never overload the truck. Never poke lambs with sticks. Remember the tenderness of a sucker lamb and handle it as such.

THE REMOVAL OF SOOTY MOULD FROM CITRUS FRUITS.

Owing to the very adverse weather conditions which prevailed in the spring and early summer, citrus growers in the coastal areas were not able to adhere to the normal spray programme. As a result scale insect infestation, particularly of the wax scales (pink wax and white wax) is now at a very high level, and, as usual, is accompanied by a copious growth of sooty mould. Even if the usual sprays were applied in the autumn, it is probable that many growers will be considerably inconvenienced by the presence of this growth on the fruit. The fungus, as most growers are aware, subsists on the sweet secretions of certain scale insects, notably pink and white wax. Except in very severe cases, it causes little direct injury to the tree, but the disfiguration of the fruit is a serious matter.

Various methods are used for the removal of sooty mould. In all of them, injury to the rind should be avoided at all costs, because it opens the way to infection with blue or green mould in the fruit. With moderate blemishes, a light brushing of the fruit will suffice. If the fruit is badly affected, brushing, sufficient to remove the mould, may seriously injure the rind. Cleaning the fruit in a rotating barrel partially filled with sawdust is a method very commonly used, but has little to recommend it. Damaged rind and bruised flesh too often result from this procedure.

If washing has to be resorted to, the fruit should be immersed for about one minute in a solution containing ¼ lb. of boracic acid and ¼ lb. chloride of lime to each gallon of water. This solution has been used extensively by growers and has been found very satisfactory. After immersion in the cleansing solution, the fruit should be well washed in clean water to avoid a whitish deposit on drying, and then should be dried thoroughly before packing.

Removal of the sooty mould by a spray before the fruit is picked is rarely practicable, and should be considered only as an emergency measure.

—*N. Caldwell.*

Poultry Feeding.

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THERE is probably no matter of greater importance to the successful poultry raiser than that of feeding. For this reason and to assist in the economical utilisation of the various foods available, poultry raisers should have a thorough knowledge of the principles underlying feeding. Although it is possible for many to buy mixed foods suitable for either egg production or the growth of young stock, it is not always advisable for the commercial poultry raiser to rely solely on these foods, for the distance from the manufacturer adds considerably to their cost; besides it may also be possible for the poultry keeper to make use of foods obtainable in different localities at lower values.

Poultry, as with all livestock, require food first for the maintenance of the bodily functions—that is, the supplying of heat and energy and repair of waste tissue, the surplus only being used for body development, or, in the case of moulting stock, the growth of feather, and in laying stock the production of eggs. It is possible, and it frequently happens, to retard the development of growing stock by incorrect feeding, and in adult stock to just maintain the birds in perfect health without procuring the desired production of eggs. It is, therefore essential for the poultry raiser to realise at the outset that under-feeding is not conducive to satisfactory results, also that the production of eggs or the bodily growth of young stock can only be obtained by feeding quantities in excess of the bodily requirements of the bird.

To attain success in poultry feeding, a practical knowledge of food values, the classification of ingredients, uses of these ingredients, and the composition of various poultry foods is necessary.

CLASSIFICATION OF FOOD INGREDIENTS.

The food ingredients are generally classified in the following groups:—Proteins, carbohydrates, fats and oils, fibre, ash, and moisture.

In addition to this classification, most careful consideration has to be given to substances known as vitamins, for it has been proved by experiment that it is impossible to obtain correct development in growing stock, or satisfactory egg production from laying hens, with a properly balanced ration of protein and carbohydrates if certain vitamins are absent. Further, the absence of essential vitamins is responsible for diseases of a malnutritional nature and the reduction of natural resistance against diseases.

Protein.

Protein is a compound built of nitrogen, hydrogen, oxygen, and a few minor constituents. During the process of digestion the insoluble proteins are converted into soluble amino-acids which are absorbed by the walls of the intestines, passing into the circulating blood, by which means they are transported to the various parts of the body to fulfil their functions. There are about twenty known amino-acids, many of which are essential to the well-being of the fowl. All forms of these acids are not found in any one class of food, consequently it is necessary to have variety in the ration in order to avoid the absence of any essential amino-acid.

As there is approximately 20 per cent. of protein in the body of the fowl (live weight), the importance of feeding an ample supply of protein can be understood, but it is not wise, in fact harmful, to feed protein-rich feeds to excess. In the first place, protein-rich foods are generally the most expensive of the food material available, and for this reason an excess is uneconomic. Secondly, protein cannot be stored in the body for future requirements. The surplus after being converted into amino-acids is divested of its nitrogen by the liver and converted into fat, and is stored as such, and the separated nitrogen voided as uric acid through the kidneys. Therefore, as well as an excess being uneconomic, it places an undue strain upon two vital organs—namely, the liver and kidneys.

Carbohydrates.

Carbohydrates are compounds of carbon, hydrogen, and oxygen. Substances such as sugars and starches are carbohydrates. During digestion these substances are broken down into simple sugars and absorbed. After absorption these sugars combine with the oxygen of the blood and are converted into carbon dioxide and water. The process of oxidation yields the heat and energy. Excess of carbohydrates are stored as fats.

Fats.

Fats are compounds of carbon, hydrogen, and oxygen. The oxygen content is about 11 per cent., whereas that of carbohydrates varies from 49 to 53 per cent. Fats and oils are chiefly used by the bird to supply heat and energy, the surplus being stored as fat. Owing to the greater quantity of oxygen necessary to oxidise fats and oils, due to its lower oxygen content, a given quantity of such substance will represent more energy than a similar quantity of carbohydrates.

Fats are not so easily digested as carbohydrates, and should not be fed to excess. As heat and energy produces, fats are worth from 1·9 to 2·5 times as much as carbohydrates.

Mineral Matter.

Mineral matter is that portion of plant or animal life that is left after burning. It is used in building up the frame, and ensures the proper functioning of body fluids. It has been established by practice that all minerals required by poultry are not present in the usual food supplied on commercial farms, also that the mineral requirement of the fowl varies with age. Only a sufficient quantity of mineral matter is absorbed by the fowl for immediate requirements, consequently a continuous supply must be fed.

Fibre.

Fibre includes the least digestable of foods, such as the outer cells of grains and fibrous matter in plants. Excessive quantity of fibre are to be avoided, as they are not only indigestible by poultry but, when excessively fed, especially in young stock, irritate the intestines.

Vitamins.

Vitamins are now known to be chemical substances, and may be classed as accessory food factors. No matter how well a ration may be balanced, without these substances satisfactory results cannot be obtained. There are five vitamins, commonly known as A, the B Group, C, D, and E.

Vitamin A may be referred to as a growth-promoting factor. It is built up by plants, and is found in green feeds, lucerne chaff and meal (commonly used as a green-feed substitute), bran, yellow maize, and whole wheat. Cod liver oil is also rich in *Vitamin A*. The absence of this vitamin in a ration fed to adult stock will cause nutritional roup and render the birds more susceptible to coccidiosis, fowl pox, severe colds, tapeworm infection, &c. Its presence in sufficient quantity will increase production, hatchability, and better development in growing stock.

It has been estimated by one authority that it is necessary to feed with bran and pollard 5 per cent. dry lucerne and 30 per cent. yellow maize meal with grain feeding in the evening of equal parts yellow maize and wheat to supply all the vitamin A necessary to good production.

The most economic form of supply of this vitamin is green feed and yellow maize, while the most convenient, in the absence of either of these foods, is 1 per cent. of a good grade of cod liver oil.

Vitamin B.—This vitamin is common to most of the foods fed to poultry, and no trouble has been recorded due to its shortage.

Vitamin C.—It was at one time thought that poultry were not susceptible to scurvy, but a recent report of an American authority indicated that growing chickens were subject to the disorder, but only after feeding a ration that would not be used commercially. This vitamin does not appear to be of importance in poultry feeding.

Vitamin D.—This vitamin, with vitamin A, is most important in the feeding of poultry. It is essential for the assimilation of the calcium and phosphorous, and naturally most important to the growing birds. This vitamin is present in abundance in cod liver oil and animal fats. Sunlight enables it to be developed in the body of the bird. With modern conditions of rearing it happens that chickens, and at times adult birds, do not get all the sunlight they should. In such cases cod liver oil can be used as a substitute. Prolonged over-feeding of vitamin D produces loss of appetite, followed by loss of weight, general ill-health, and ultimately death.

Vitamin E.—This vitamin is associated with reproduction. Investigations have shown that the feeding of rats with a ration in which this vitamin was absent brought on sterility. Sterility was cured by the feeding of small quantities of wheat germ oil. In practice breeders would guard against the possible cause of infertility by feeding good sound wheat of wheat germ oil and green food, particularly lettuce, in the ration of their breeding stock.

Digestibility of Foods.

The chemical composition of a food does not indicate its digestibility, and as regards poultry little is known on the subject. It is a question that can only be definitely ascertained by feeding experiments conducted with poultry.

Palatability of Food.

Results are not obtained by making up a ration with definite proportions of the constituents referred to later unless the fowls will eat it. If they become hungry enough they will consume a sufficient quantity of almost any food, but it will be at the cost of a very much reduced egg yield. Upon analysis, barley is found to be a food carrying almost the right quantities of protein and carbohydrate essential for egg production, but when put into practice we find that fowls do not relish the grain, and have to be gradually accustomed to consume it. It may be as well here to mention that in making any change in the ration to laying stock, do so gradually, as sudden changes in the diet cause a reduced egg yield and frequently a false moult.

METHODS OF FEEDING.

Several methods of feeding are commonly practised, and in many instances with equal degree of success. Each method has its own advantage and appeals to the individual feeder.

The methods are known as—(1) wet mash and grain, (2) dry mash and grain, (3) and all-mash.

Wet Mash and Grain.

The mash is a mixture of different ingredients, moistened to the extent that when a handful is squeezed it will remain in mass form, and when dropped a few inches will break up into small particles. It would be more in keeping with this class of mash if it were termed "moist" instead of "wet."

With this type of feeding the mash has to be prepared daily and distributed to the birds, care being taken to feed sufficient for their requirements and not allowing any to remain unconsumed—say, after an interval of half-an-hour after feeding. The mash should be placed in shallow narrow tins or troughs, and as the food should be consumed within about half-an-hour there should be no lack of feeding space or the more timid class of bird will not procure all that she requires for maximum production.

It is usual to feed wet mash first thing in the morning and grain late in the afternoon. Many breeders reverse this order with successful results, and find that it fits in better with the daily routine.

Dry Mash and Grain.

A mash similar to that used for a wet mash is prepared dry and placed in hoppers. Birds are at liberty to consume the food at will, and although certain feeding space has been found necessary for best results the more timid fowl has a better chance of securing its requirements from a limited space than is the case in wet mash feeding. One foot of hopper space should, however, be allowed for each ten birds. The advantage of the system of feeding is that instead of mixing and feeding mash daily a quantity can be prepared and distributed once per week, and so reduce the labour of feeding. The most serious disadvantage, however, that the writer sees in this method is that the constant supply of feed encourages rats to harbour in the poultry pens.

With this system of feeding grain is usually fed during the afternoon, allowing birds ample time to scratch and find grain distributed.

All Mash.

As the name suggests, nothing but mash is fed. A suitable mixture is made and placed in hoppers. The birds have access to this food at all times throughout the day. This system of feeding possesses advantages over both the other systems previously mentioned, although it has the disadvantage of encouraging rats. With the all-mash system, quantities of food can be placed out once per week, thereby saving the daily attention of feeding. The birds are also compelled to consume a ration suitably balanced, and from practical experience this system suggests the possibility of preventing breeds of the heavy variety putting on excessive internal fat. Production with this system of feeding is equal to any other. Fowls do not take kindly to radical changes in grain feeding, but with the all-mash system the meal of various grains may be substituted without any appreciable easing in production. Naturally, the converting of grain into meals increases the cost of feeding slightly, but the saving in labour and the assurance that the birds are being fed a ration suited to their requirements appear to justify the slight increase in cost.

THE FEEDING OF CHICKENS.

In the feeding of chickens it is most important to bear in mind that nature has provided for the first day or so of the chicken's life, as just prior to hatching the balance of the egg yolk is drawn into the abdomen of the chick. Most breeders allow at least forty-eight hours to elapse before feeding. Chickens fed earlier are subject to bowel trouble. A system of prolonged starving, however, should not be practised, as it has a weakening effect, from which many chickens do not recover.

Requirements of Growth.

Chickens make very rapid growth the early part of their life. This development is most rapid during the first six to eight weeks, consequently rations having a relatively high protein content are necessary to give the best development. From experimentation it has been definitely established that rations having a crude protein content of 18 to 20 per cent. should be used during the first six to eight weeks, and after that period reduced to 15 per cent. The protein requirement of a chicken does not alter as sharply as this, but these periods and protein content are suggested as meeting the practical requirements of the poultry raiser. Part of the protein in a ration should be of animal origin.

It is a common practice among many poultrymen to cut down the protein content after the chickens are about sixteen weeks of age, in order to delay sexual development. This, we think, is desirable if the birds are maturing too rapidly, but development can be controlled to only a very limited degree. Excessive protein feeding must be guarded against, as constant and overfeeding of protein-rich foods causes deposits of urates in the ureter, kidneys, and other organs, as well as placing an undue strain upon the liver.

It is generally conceded that milk is the most desirable protein feed for chickens and growing stock, but owing to its cost its exclusive use is not possible. Wherever possible milk should form a portion of the ration. It may be given in the form of curds, semi-solid milk, butter milk, or butter milk powder. As a drink milk is excellent, but it is objectionable owing to the difficulty of keeping chickens clean. The writers favour butter milk powder, owing to the ease with which the powder may be incorporated in the mash, thereby controlling the kind of food that each chicken consumes. It has, however, no definite advantage from a feeding value point of view apart from its concentration. Proteins build up the flesh, but at the same time a bony framework is necessary. Analysis of the chicken at different ages, according to

Halnan, indicates that it was particularly important to allow for the mineral requirement from the eleventh to the twenty-fourth week. In all experiments conducted by the Department, the increased mineral intake has been allowed for by the addition of bonemeal to the mash at eight weeks of age, and by allowing the birds free access to grit (shell and hard).

Food Consumption of Chickens.

One is often asked how much food should be given to chickens. Probably no better reply can be given than the publishing of a table from actual experiments conducted in this State.

FOOD CONSUMPTION AND WEIGHT OF CHICKENS.

Age.	LEGHORNS.		AUSTRALORP.	
	Weight of Chickens.	Food Consumed Weekly.	Weight of Chickens.	Food Consumed Weekly.
	ozs.	ozs.	ozs.	ozs.
Day old	1·[illegible]	..	1·36	..
1 week	1·97	1·64	2·14	1·53
2 weeks	3·31	3·36	3·61	3·32
3 weeks	5·31	4·80	5·84	5·05
4 weeks	7·61	6·46	8·68	7·20
5 weeks	9·94	7·58	12·08	6·89
6 weeks	12·92	8·96	15·86	10·62
7 weeks	16·65	8·65	20·17	13·95
8 weeks	20·41	13·29	25·31	15·05

The variation in weight from week to week and the ever-increasing amount of food required suggests the undesirability of indicating what should be supplied.

The food requirements increase week by week, and a system of feeding where the growing birds may consume all they require is the most desirable.

The all-mash method of feeding chickens by reason of the fact that the kind of food consumed is easily controlled, and that it is always in front of the birds, is suggested as being the most desirable. All-mash should be placed in shallow trays about 1 inch in depth during the first few days. The trays are then increased to a depth of 2 inches, and by the end of the first week troughs about 4 inches wide may be used. At this age chickens will commence to scratch with more vigour, scattering the feed from the trough. This can be prevented by placing a piece of netting on top of the mash loose enough to sink as consumption takes place. During the first week 8 lineal feet of feeding space should be allowed for every 100 chickens, and later increased to 12 feet. Prior to the mash being covered with netting it is important that only a little food at frequent intervals should be placed in the trays in order to avoid wastage.

In fact, the frequent feeding of all-mash appears to induce a greater food consumption, with the result of better development.

Breeders who do not desire to feed an all-mash may make use of commercial chick grains and growing mashes. These could be fed as directed by the manufacturers. It has been the custom for many poultry raisers to use scratch grain only for a short period of a chicken's life, but in view of the more satisfactory results obtained by feeding a ration of a relatively higher protein content than chick mixtures usually have, early mash feeding appears essential.

Chickens may be reared satisfactorily upon moistened mashes and grain from about two weeks of age, but the mashes must be fed at frequent intervals. This system offers the advantage of utilising milk as a medium of moistening the mash when such is available. The feeding of dry mash, however, is suggested as a safer method of feeding, as the possibility of food becoming sour, and the probable consequent bowel trouble among chickens, is avoided.

SUITABLE ALL-MASH MIXTURE.

The following mashes have been used successfully in experiments conducted by the Department, and are suggested as a basis upon which to work. At times it may not be commercially sound to adhere rigidly and fast to the ingredients suggested, but from the table of analyses supplied it will be possible for the breeder to compound other suitable mixtures.

Ration.	1–8 Weeks.	8 Weeks to Maturity.
Maize meal	40	63
Bran	20	13½
Pollard	20	13½
Meat and Bone meal	7½	5
Dried buttermilk	10½	3½
Salt	1	1
Cod Liver Oil	1	1
Lucerne meal	..	2½
Crude protein content	17·15	14·40

REQUIREMENTS FOR EGG PRODUCTION.

The laying fowl has first to provide from her food supply for—

(1) Maintenance of vital functions;
(2) Growth requirements; and
(3) The production of eggs.

The first call upon the food supply is for that of vital functions, then growth, and any surplus nutrients are used in the manufacture of eggs. It will therefore be seen that the greater the production the greater will the consumption be, and that egg production is only possible by feeding quantities of food in excess of body requirements. It is generally estimated that a hen in full lay will consume approximately 2 ounces each of grain and mash per day. This quantity, however, will be in excess at times, and again be deficient during the period of peak production.

The majority of cereal foods available are generally deficient in protein, and in preparing a ration it is necessary to use protein-rich foods in the form of milk, milk powders, and meat meal. Protein-rich vegetable foods are available, but it has been found from experience that animal proteins give better results than vegetable. This probably is due to their greater palatability and to the fact that the range of amino-acids is wider. From practice it has been found that rations

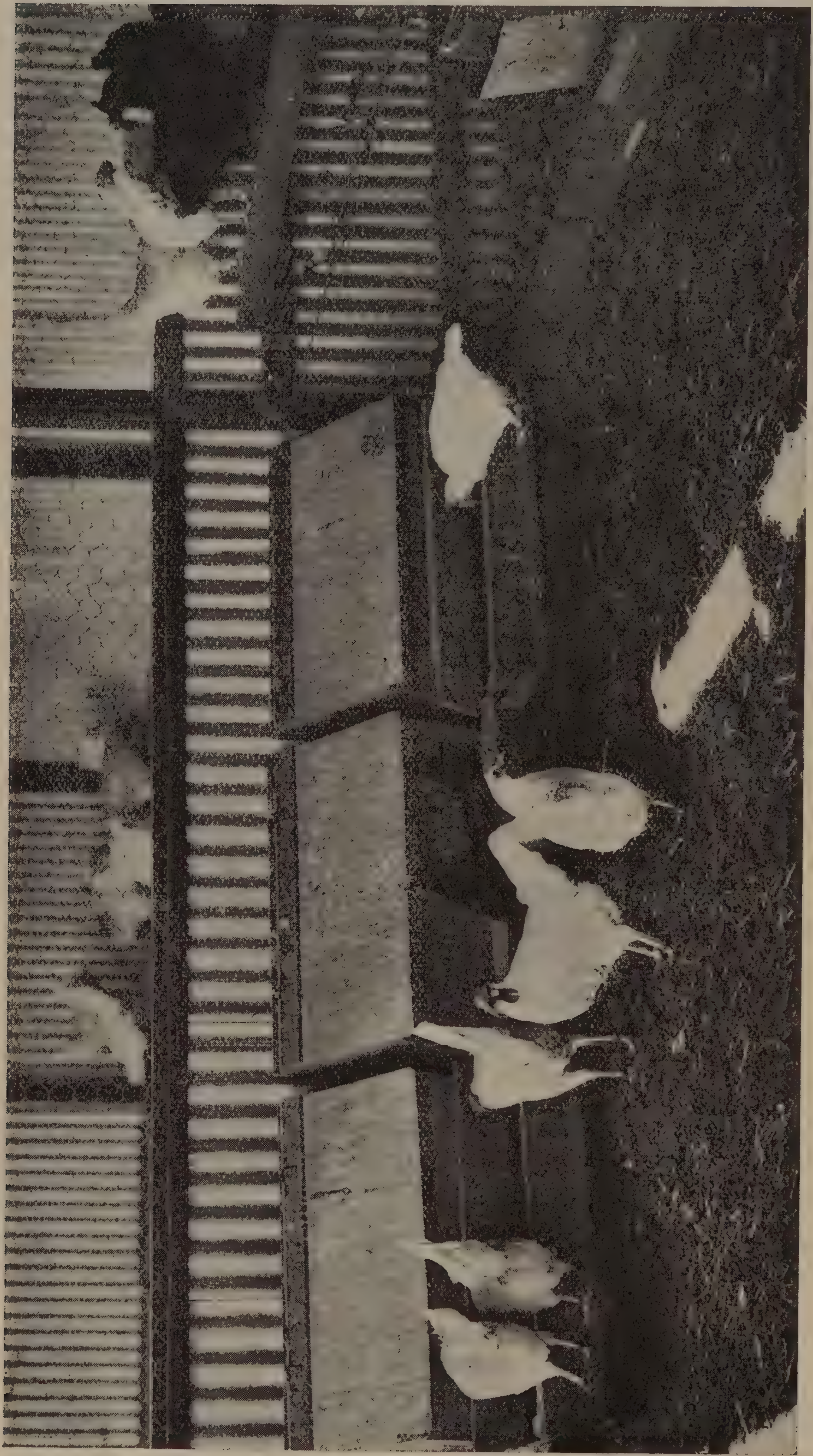
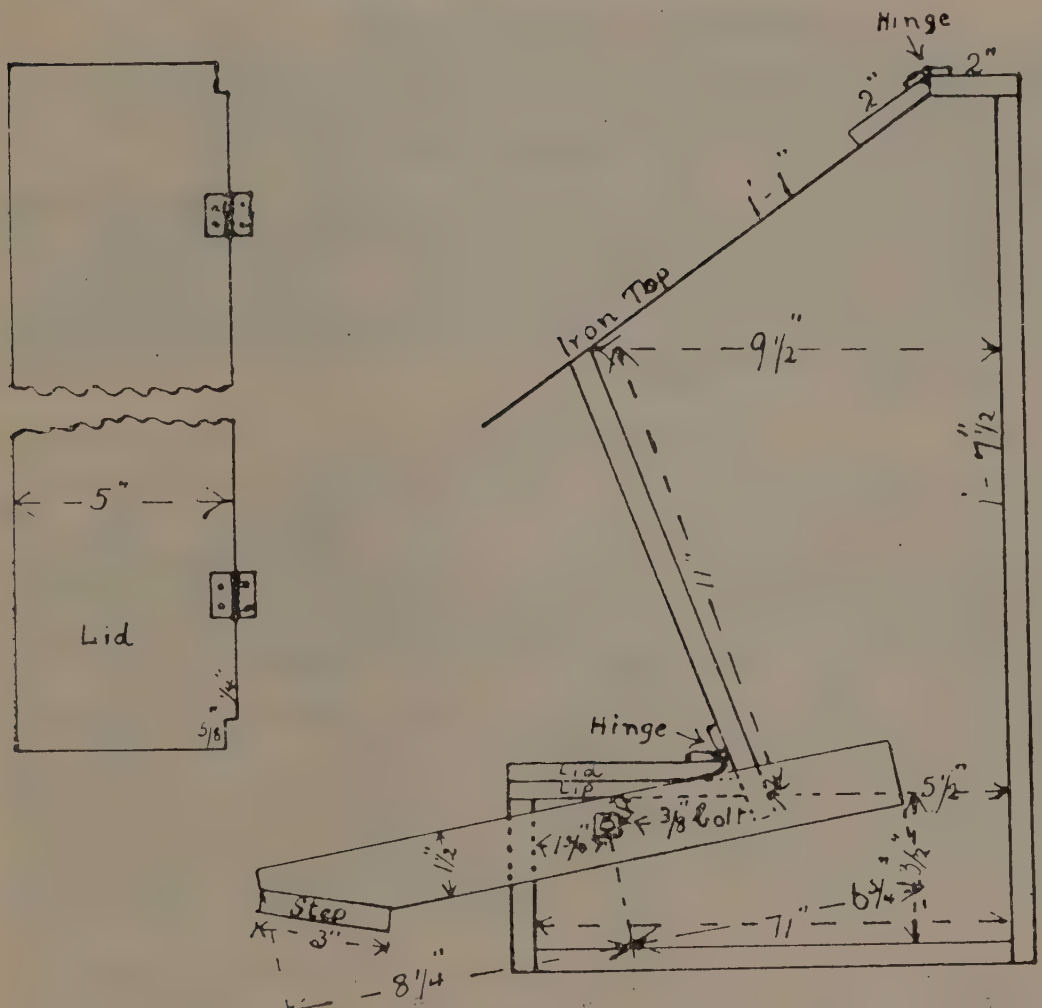


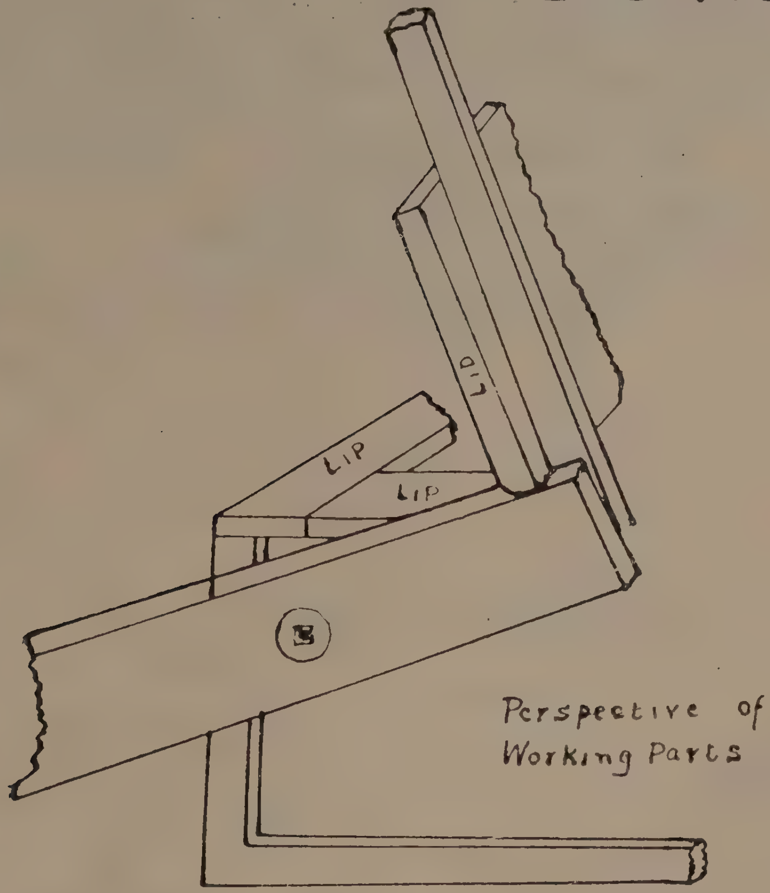
Plate 182.

Automatic feeding hoppers in use on a poultry farm near Brisbane.


Hinge
2"
2"
1'-1"
Iron Top
9½"
1'-7½"
11"
Hinge
Lid
Lip
⅜ bolt
1⅛"
1½"
5½"
3½"
6¼"
7"
Step
3"
8¼"
5"
Lid
¼"
5/8

END VIEW.

Scale ¼" = 1 inch.



Perspective of Working Parts

J. J. McL.

Plate 183.
Plan of automatic feeding hoppers as illustrated.

having a total protein content of slightly less than 15 per cent. give satisfactory results. As protein-rich foods are the most costly, it will readily be understood that the object of the feeder should be to use the minimum quantity necessary for maximum production.

The poultry raiser who does not desire to prepare rations himself may purchase laying mashes to be fed in conjunction with grain, also all mash. Most laying mashes contain from 17 to 20 per cent. of crude protein, and when fed in conjunction with grain, say equal parts of maize and wheat, the total crude protein content of the ration is reduced to the vicinity of from 14 to 15 per cent.

In addition to the protein and carbohydrate, the mineral content of the layers' ration has to be taken into consideration. The average amount of carbonate of lime of the egg shell is one-fifth of an ounce. To supply the requirements, say, in the mash, 4 per cent. of calcium carbonate would be necessary, but as hens not laying would only void the material it is better practice to have shell-forming material in the nature of limestone and shell grit always before the bird in separate receptacles.

Commercially, yolk colour does not appear to have as yet caused us any concern, but the consuming public do not like an excessively pale-yolked egg, and to overcome this green feed and yellow maize should form a definite part of a laying ration. Both foods are rich in vitamins, and green feed materially assists in supplying the mineral requirements of poultry. In the absence of green feed, lucerne chaff or meal should be used.

The manner in which layers may be fed varies. All systems previously referred to have proved successful. The most popular at the present time is the feeding of dry mash and grain, although all-mash is coming more into vogue. For those who desire to prepare mixtures, the following rations are suggested as a working basis:—

RATION—GRAIN AND MASH.

Mash.		Grain.	
	Per cent.		Per cent.
Lucerne chaff or meal	10	Wheat	50
Bran	28	Maize	50
Pollard	30		
Maize meal	20		
Linseed	2		
Meat meal	10		

Supplements to each 100 of mash—

½ lb. Salt.
2 lb. Sterilized Bone Meal.

All Mash.

	Per cent.
Meat Meal	5
Lucerne Chaff	6
Linseed	1
Maize Meal..	30
Bran	20
Pollard	40

Supplements—

Bone meal	2 lb.	To every 100 lb. of Mash.
Salt	½ lb.	

CARE OF MOULTING HEN.

It is a common practice among breeders to give little attention to moulting birds. In many instances they receive nothing but a grain ration. Feathers contain a considerable amount of protein, and the most economical manner of getting birds back into production is to feed protein-rich foods as provided in a laying ration. Moulting may be induced by the feeding of nothing but grain at or about the time birds usually moult. When once the moult has commenced laying rations should be supplied, as it will take about a fortnight for the manufacture of the first egg after the moult is completed.

FATTENING.

Two classes of birds have to be considered—old hens and cockerels. The ability of the feeder to do much with old hens in good condition is questionable, but those slightly out of condition may be improved with ten to fourteen days' crate feeding. From experiments it has been found economical to rear cockerels to the various marketing stages on the growing rations used for pullets. Ten to fourteen days of crate feeding for these birds would undoubtedly add to their market value. As the old hens or young cockerels are to be handled they should be freed of external and internal parasites before being submitted to a fattening process. The crates could be small coops 2 feet wide, 3 feet deep, and 3 feet high. These crates hold about six birds, and if the floor is wire netting and off the ground the droppings would fall through and the birds will be kept clean. The front should be of wire or slats wide enough apart for the birds to get their heads through to feed from a trough in the front. An all-mash mixture of a relatively high protein content fed as a gruel three times a day will undoubtedly improve condition. With this system of feeding water is not necessary. Any food left over, say, after half-an-hour, should be removed in order to keep the appetite keen. A mash of equal parts maize meal and pollard, plus 10 per cent. butter milk powder and 5 per cent. meat meal, is suggested.

PREPARATION OF MASHES.

On the majority of farms the various ingredients that go to make mash are either mixed with a shovel upon the floor of the feed room or in some trough.

If the mash is to be fed wet it is a good idea to soak the lucerne chaff or meal in water over night. Just sufficient water should be used to make the mash of the correct consistency. The salt used in the mixture should be dissolved in the water first. This ensures equal distribution.

In making a dry mixture the salt should be added to the protein-rich foods in order to increase the bulk through which the salt is distributed. This action ensures an even distribution of salt throughout the mash.

Much labour will be saved and better mixing of the various ingredients ensured by using a mash mixer. An appliance that serves the purpose is easily constructed by the poultry raiser. The mixer consists of a drum constructed of 22-gauge galvanised sheet iron with tongued and grooved pine ends, as illustrated. A pipe of 1¼-inch diameter is passed through the centre of the drum, fitting into hardwood bearings at each end. This pipe can be keyed to the drum by boring a hole through the pipe close to the drum and using a piece of No. 8 wire as a key. The No. 8 wire must be bolted to the drum.

The mash is mixed by a tumbling process, and to assist in raising the mash on the side of the drum while it is revolving four battens should be attached lengthwise inside the drum 2 inches from the iron. The battens should be of 2½ by 1-inch timber.

The diameter of the drum is 3 feet 6 inches, and the length equal to the width of the iron. The sheet iron to pass around the drum must be riveted end to end, and the sides attached to the pine ends every 2 inches with screws. A convenient sized opening, the full length of the drum, must be left for filling. A sliding close-fitting door must be provided.

When using cod liver oil, an equal distribution is ensured by corporating it in the bran in the first instance.

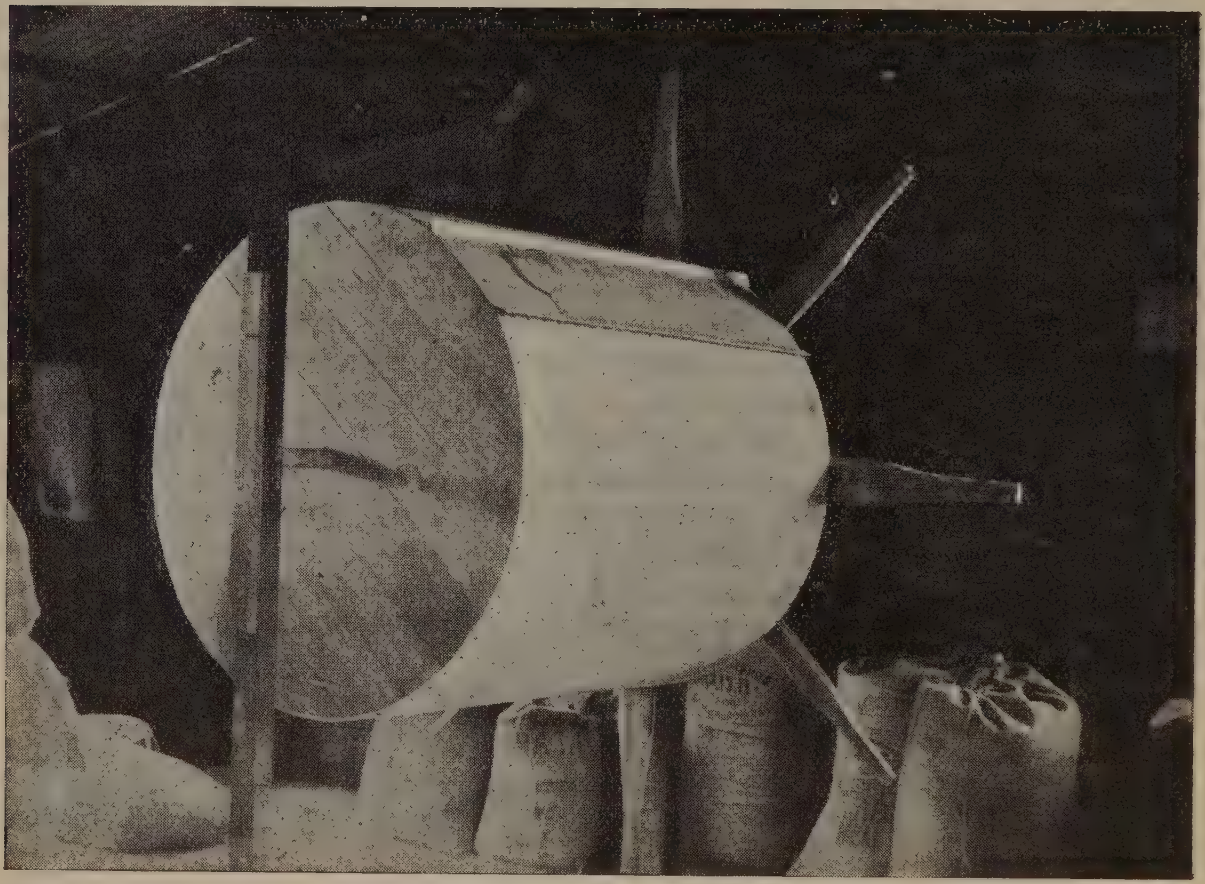


Plate 184.
A handy mash mixer.

Dry-mash Hoppers.

It is most difficult to design a dry-mash hopper that is efficient in all respects; however, the accompanying illustration will prove quite satisfactory. This hopper, being wider at the bottom than the top, tends to obviate the trouble of mash sticking which is so common in other designs. In addition, the lip on the feeding trough will prevent much wastage of mash. Such a hopper could be built in lengths to suit the number of birds, allowing 1 lineal foot of feeding space to every ten birds. The feeding space, however, could be increased where all-mash is fed by allowing 1 lineal foot to every eight birds.

Wet mash should be fed in troughs or on a sheet of iron; after the birds have consumed the mash these receptacles should be stood up to avoid contamination.

TURKEY FEEDING.

No food should be given for at least forty-eight hours after hatching. Hard grit, charcoal, and water should be the first material provided. The hard grit assists in mastication, and charcoal has no equal as a bowel corrector. Turkey chickens will gorge themselves if allowed, and this gorging is responsible for a considerable amount of trouble. Turkeys in their wild state gather their food very slowly, and it is found best to imitate them as far as possible by feeding the young chickens only a little at a time, and fairly frequently. This prevents them from overloading their digestive organs, and helps to retain that keenness of appetite which is essential to success.

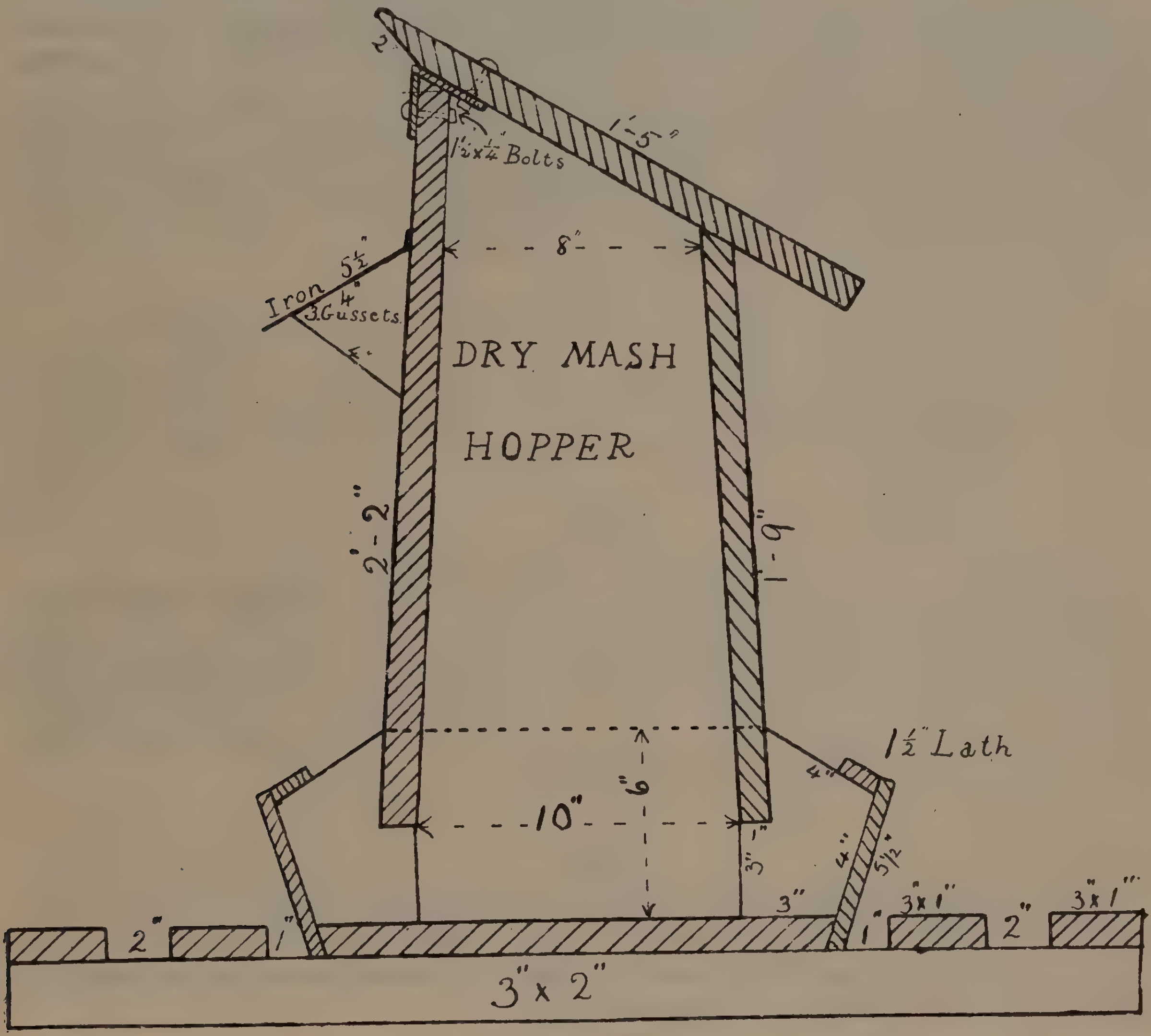


Plate 185.

Stale bread soaked in milk and then squeezed fairly dry is the most handy food on the farm, and gives excellent results. This can be fed five times a day for a few days, and variety can be added by the replacement of some of the meals with chick grains, mashes of bran and pollard mixed with milk, to which is added a small amount of minced meat, and tender green feed. This mash should be made crumbly and not sticky.

When on range the quantities of food will vary according to what they can gather for themselves, but surplus milk can be fed at all times either thick or fresh, but it is as well always to feed it in the same condition. Green feed should be fed in abundance to both growing and adult stock, but where range is allowed on good green pasture it is not so important.

Grains should always be fed at night, to induce the flocks to return to their camps. Oats, maize, and wheat are suitable for this purpose.

In the management of turkeys, especially in the rearing of young stock, cleanliness is essential. Food should not be allowed to lie about, and a strict outlook must be kept for vermin of all sorts.

DUCK FEEDING.

Ducklings require no feed for forty-eight hours after hatching.

During this period they should have water, coarse sand, and charcoal constantly before them. A mash that will give good results if fed from the first meal until they are about four weeks old is prepared by mixing together—pollard, 10 lb.; maize meal, 8 lb.; dried butter-milk, 2 lb.; bonemeal, ½ lb.; fine salt, 2 ounces. If this mash is mixed, the amount for each meal may be moistened as required. Feed several meals daily—a little, and often, is a good motto. After four weeks they could be fed a mash similar to that fed to the adults.

Adults mash—

	Per cent.
Pollard	55
Bran	25
Maizemeal	10
Meatmeal	10
Bonemeal	1
Fine Salt	½

Feed growing stock three meals daily. With adults, a small meal of whole maize could be fed in the evening in addition to the mash. In fattening ducks, cheap foodstuffs in the form of potatoes, pumpkins, &c., may be boiled and added to the mash to the extent of 40 per cent. Chaffed young greenstuff should be added, but when using other cheap foodstuffs omit it, otherwise the mash will be too bulky.

Water.

Ducks must always have access to drinking water. This is *most important* with ducklings, and the water vessels should be deep enough for them to submerge their heads. Many ducks die annually, and the cause can be attributed to lack of water.

COMMERCIAL FOODS AND THEIR FEEDING VALUE.

Barley.

Not a popular food among poultry-keepers nor do fowls consume it readily. It has a fair feeding value, but in order to increase its palatability it should be soaked or sprouted. When corn and wheat are high in price, barley may be used to the extent of 50 per cent. of the grain mixture, but the change over should be gradual.

Beans and Peas.

When whole, stock do not take kindly to either of these grains; crushed they add to the protein content of the mash, and may be used to the extent of 10 per cent.

The Grain Sorghum.

In the drier areas this crop may be grown successfully when maize or wheat are failures. They are slightly higher in protein content than maize, but do not contain the fats. Feterita and Milo are preferred, and are extensively used by some breeders with a good deal of success and economy in feeding. Some varieties of the grain, notably Kaffir corn, are credited with a binding effect, but as an offset against this plentiful supplies of green feed can be used.

Maize.

This is one of Queensland's staple grain crops of which poultry are very fond. Large grain should be cracked, but the smaller varieties can be fed whole. When purchasing maize for grain feeding, it is as well to try and secure the small grain. The quality is then easily judged, and there is no waste. Cracked grain should always be sieved before being used, and the fine powder used in the mash. Yellow corn should be used in preference to the white on account of its *vitamin A* content.

Oats.

In some places oats is one of the principal poultry foods. Most of Queensland's supply is, however, imported, and it therefore cannot be used economically in large quantities. It is, however, desirable to add variety to the ration of breeding stock by using a proportion of this grain.

Rice.

In the northern portion of Queensland, where this grain is grown, it may be possible to use quantities economically. It is a very starchy food of a fattening nature, but can be used to the extent of one-third of the grain ration. Crushed or ground rice should be used with care. It has a tendency to go rancid.

Wheat.

This grain provides the bulk of our poultry food. It is readily consumed by poultry, and can be fed as a part or whole of any grain ration, the market price of various grain foods available being the guide as to the quantities used. Plump wheats of a hard nature are of better feeding value than pinched grain or full soft grains.

Bran.

Bran is rich in protein and mineral matter, but contains a considerable quantity of fibre. This fibre is useful in adding bulk to the ration. It also assists in making a mash when fed wet of a desirable consistency. Use at the rate of up to 30 per cent. of the mash.

Pollard.

Pollard has a greater proportion of carbohydrates than bran, but not so much ash and fibre. It forms the principal constituent of mashes, and may be used to the extent of 60 per cent. of the total mash.

Maize Meal.

This meal is of especial value in fattening poultry. Some should be used in all mashes.

Ground Oats, Rolled Oats, and Hulled Oats.

Ground oats—that is, oats without the hulls—is an excellent food for both laying and growing stock. The use of these foods is largely governed by the price.

Linseed Meal.

Rich in oils and proteins, also fibre, it may be used to the extent of 2 per cent. in the laying mash, and increased slightly during the moulting period.

Cotton Seed Meal.

Cotton seed meal, on analysis, would appear to be a splendid food for poultry, but in practice the extensive use has not given good results. A good grade may be used to the extent of 5 per cent., but never exceed this quantity.

Peanut Meal.

Peanut meal is protein-rich and easily digested meal. The keeping quality of the food is poor, being inclined to go rancid, but it may be used to assist in building up the protein content of mashes.

Meat Meals.

Meat meals vary considerably in their analysis. They are essential for high egg-production. The quantities to be used vary according to conditions under which poultry are kept. In closed runs where no other class of animal food is available, they may be used to the extent of 10 per cent., but with stock on free range during periods when animal food in the form of insect life is plentiful, the quantity should be considerably reduced.

Dry Crushed Bone and Bone Meal.

These materials are essential for the development of the bony structure of young growing stock and beneficial to laying birds. Quantities up to 5 per cent. may be used. Poultry keepers who are a distance from markets may burn any bones about the place, which renders them easily crushed, and so have a supply of mineral matter suitable for feeding to young growing stock.

Milk.

If all poultry keepers had a good supply of skim milk or butter-milk there would not be such a large number of poorly developed stock. There is no better animal food for stock than milk or milk products. In a sour state it is recommended by some authorities as preventative of diarrhoea and coccidiosis. In feeding, vessels should be kept clean, and although the milk is being fed in a sour state, putrification must be avoided.

Dried Buttermilk.

This is an excellent food for those who have not the fresh product, and in a State such as Queensland, where the dairying industry is so extensive, poultry breeders should be assured of continuity of supplies. Milk and milk products appear to be a tonic as well as a food, and highly suited for laying, growing, and breeding stock. When used for the latter purposes, it has been our experience that the hatchability of the eggs has been increased. It may be used as the sole source of animal food, or in conjunction with other forms of animal food. The price will govern its use.

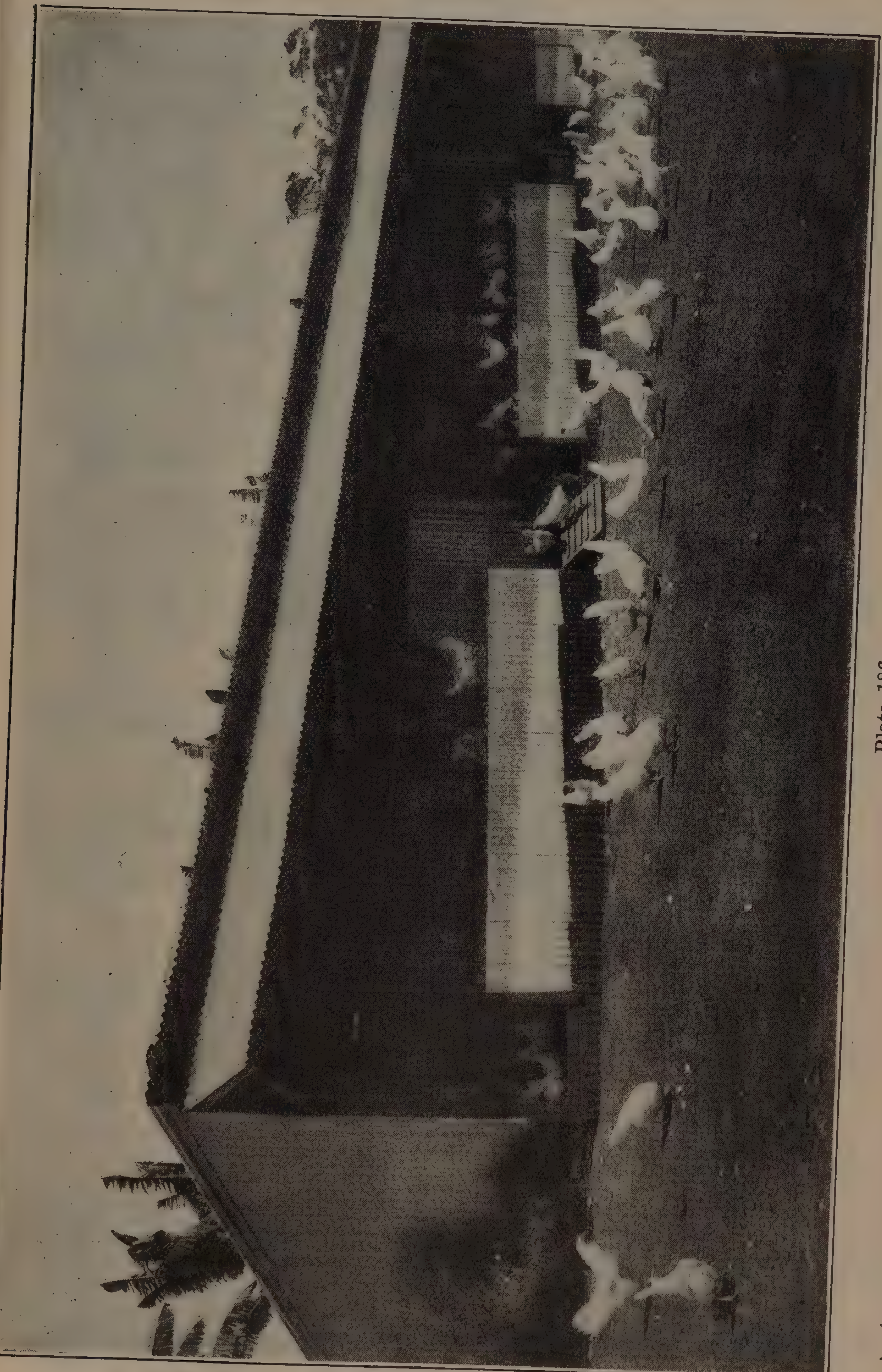


Plate 186.

An intensive laying house on a poultry farm near Brisbane, built according to the plan shown on page 169 of the February issue of the Journal.

Green Feed.

Some sort of succulent green food is essential to maintain the health and vigour of stock.

It has long been recognised as an important food for poultry, but it is only during recent years that scientists have found that green foods have been supplying an element essential to life. Green feed stimulates the liver and increases the secretion of digestive juices. The kinds of green feed most valuable and relished by fowls are the young, tender-growing portions of lucerne, lettuce, kale, rape, silver beet, barley, oats, maize, sorghums, &c. In fact, all green foods are good, but it should be young or tender. The quantity used is dependent upon supplies and general conditions. When feeding by itself, say, at midday, give the birds as much as they will eat. If used in a wet mash, the quantity could be as high as 25 per cent. of the bulk, and during droughty periods, when poultry foods are costly, green feed can be used to the extent of 60 per cent. of the mash; but when fed in these quantities, two mashes, one at 7 a.m. and one about 1 p.m., should be fed daily, followed by a grain feed, say, at 5 p.m. Poultry have not a great holding capacity, hence the necessity of feeding two mashes to enable them to deal with the bulk.

When fresh green feed cannot be obtained, lucerne chaff or meal makes an excellent substitute. This class of food, being dry, however, cannot be used to the same extent as if green. By weight, 12 per cent. should be the limit. If feeding on the wet mash, the dry lucerne can be soaked over-night with just enough water to mix the mash. This softens the lucerne and makes it more easily digested.

Grits.

Shell grit, limestone, or crushed bone should be provided. Plentiful supplies of oyster shell or ground lime should always be available, while bone may be supplied either in the form of meal or grit.

Hard Flinty Grit.

Hard pieces of rock, sand, &c., are necessary for poultry to grind their food, and should be in free supply, particularly with stock confined to pens. Without grit it is impossible for stock to digest their food thoroughly, and any system of feeding where this is not supplied is wasteful.

Charcoal.

This may be fed either in the mash or be made available to stock at all times. When it is desired to feed powdered charcoal in the mash it should be used at the rate of 2½ per cent. Charcoal is valued for its mineral content and its action as an aid to digestion.

In feeding all grit continuity of supply is essential, otherwise stock are liable to gorge themselves, with resultant troubles in the nature of distended crops, &c.

Salt.

With a good system of feeding—that is, variety and plenty of green feed—there is generally a sufficient supply of salt to meet the body requirements, but small quantities, 8 oz. to every 100 lb. of mash should be used to make the food more palatable, with the result of greater consumption and production. Salt, however, needs to be well mixed with the mash; when wet mash is fed it may be dissolved in the water, but when fed dry too much care cannot be exercised in thoroughly distributing it throughout the mash. Excessive quantities are poisonous.

COMPOSITION OF SOME POULTRY FOODS.

CRUDE NUTRIENTS.

Food.	Protein.	Fat.	Carbohydrates.	Fibre.	Ash.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Barley	8·6	1·5	71·0	2·7	2·2
Beans	25·4	1·5	48·5	7·1	3·2
Kaffir corn	9·9	1·4	74·9	1·5	3·0
Maize	9·5	4·0	69·3	2·8	1·4
Oats	10·3	4·8	58·2	10·3	3·1
Rice	7·6	1·9	66·7	9·3	4·9
Wheat	12·8	2·0	67·7	2·4	1·7
Bran	15·8	2·6	56·3	9·8	4·9
Cotton-seed meal (decort.)	41·0	7·0	29·0	8·0	6·0
Linseed meal (new process)	27·2	0·8	40·7	13·9	6·2
Maizemeal	8·6	3·7	71·4	2·0	1·3
Peanut meal	47·6	8·0	23·7	5·1	4·9
Pollard	15·7	3·6	61·4	5·8	3·1
Meatmeal	54·4	8·0	6·1	..	23·5
Skim milk	3·8	0·1	4·9	..	0·8
Dried buttermilk	34·5	1·1	49·1	..	8·3
Lucerne chaff	20·7	1·4	40·9	20·0	9·0

TABLE OF WEIGHTS AND MEASURES.

In order to prepare mashes which will give maximum results it is necessary for the various ingredients to be weighed. As scales are not available on all farms the average weight of the various kinds of foodstuffs most commonly used is given for two convenient measures, the kerosene tin and the quart measure. These weights refer to the measures being filled but not pressed.

Kerosene Tin.

Bran	12 lb.	Maize (whole) ..	28 lb.
Pollard	18 lb.	Maize (cracked) ..	25 lb.
Lucerne meals ..	12 lb.	Wheat	30 lb.

Quart Measure.

	lb.	oz.		lb.	oz.
Barley meal	1	8	Linseed meal ..	1	0
Bone meal	1	12	Pollard	1	0
Bran		8	Salt (fine)	2	0
Maize (whole) ..	1	12	Wheat	1	12
Maize meal	1	8	Wheatmeal	1	8
Meatmeal	1	8			

MILK AND CREAM TESTING EXAMINATION.

An examination will be held for certificates of proficiency in milk and cream testing and milk and cream grading on Saturday, 24th July, 1937; and in butter making and cheese making on Saturday, 31st July, 1937. The examination will be held in convenient centres. Candidates should notify the Under Secretary, Department of Agriculture and Stock, Brisbane, not later than the 5th July.

Entrance fee 5s. for each subject should accompany the notification, with an additional 10s. 6d. if a special country centre is desired as the place of examination.

Candidates must not be less than 18 years of age on the day of examination.

Soil Problems in Brigalow and Belah Country.

E. HIRSCHFELD, M.D., and R. S. HIRSCHFELD.

Subjoined is a report submitted to the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, who has approved of its publication as a contribution to a discussion on a subject of importance to Queensland farmers and graziers.

The report is especially interesting on account of its explanation of the melon-hole phenomenon. The large depressions characteristic of the brigalow melon-hole country are reminiscent of the shell holes of the war zone, and set the mind wondering what has caused them. The authors of the report seem to have hit upon a feasible explanation, which is sure to interest readers of the Journal who are familiar with the peculiarities of our brigalow country.—Editor.

BRIGALOW and belah country stands in a class of its own. Having lived on it, grazed on it, and improved it for the past eight years, we must outline first its features as we see them—features which set it apart from other types of land in the West.

1. The first thing to impress one is the density of the scrub. So dense is it that it is not easy for man or beast to make their way through it. We counted between 800 and 1,000 trees per acre. We look for a dense growth of trees in the rain forests near the coast, but do not expect to come upon it in our western lands with their limited rainfall.

2. Brigalow and belah country is practically useless for grazing purposes until it is rung. The trees are in possession of the soil, its mineral wealth, its water, and do not give grass and herbage a chance to grow. The dense scrub, however, affords shelter from westerly winds and warmth for stock during winter.

3. The peculiar formation of melon holes breaks up the level surface of the earth to such an extent that at first sight the country looks almost hopeless for agricultural purposes. The origin of these melon holes has never been explained satisfactorily. The name fits them. Many look as if they had been punched out; they average 10 or 20 feet across, are from 2 to 4 or 5 feet deep. Some melon holes are not round, but lengthwise and form small gullies 70 or more feet in length. After rain they hold water for quite a while, and are popular with the stock. Cattle seem to prefer the stagnating water in melon-holes, probably because it contains mineral matter. We found it a good plan to throw a few runners of water couch into the melon holes; they take root readily and reduce evaporation to some extent. When the hole dries up the water couch affords to stock a pleasant change from the ordinary pastures and remains green longer than the grass on the ordinary surface.

4. No other land in the west costs so much to improve; no other land will provide more employment than the brigalow and belah country. The ringbarking averages from 4s. 6d. up to 10s. an acre, according to the density of the scrub. And the man who does the ringbarking earns all the money he gets. The erection of an effective dog and rabbit-proof fence in brigalow and belah country may run to between £140 and £150 per mile. The provision for water requires the sinking of bores or making of dams.

5. The liability of the brigalow to sucker makes it risky to clear up the country for at least three to five years after it is rung. The timber fights back: the brigalow with its suckers and the belah with its seedlings.

Worst of all is the ti-tree, which runs in narrow belts and takes advantage of the country as soon as its big neighbour has died. Indeed, it is a stubborn country.

6. Once the brigalow and belah country is improved, it begins to repay the time, thought, labour, and money expended on it.

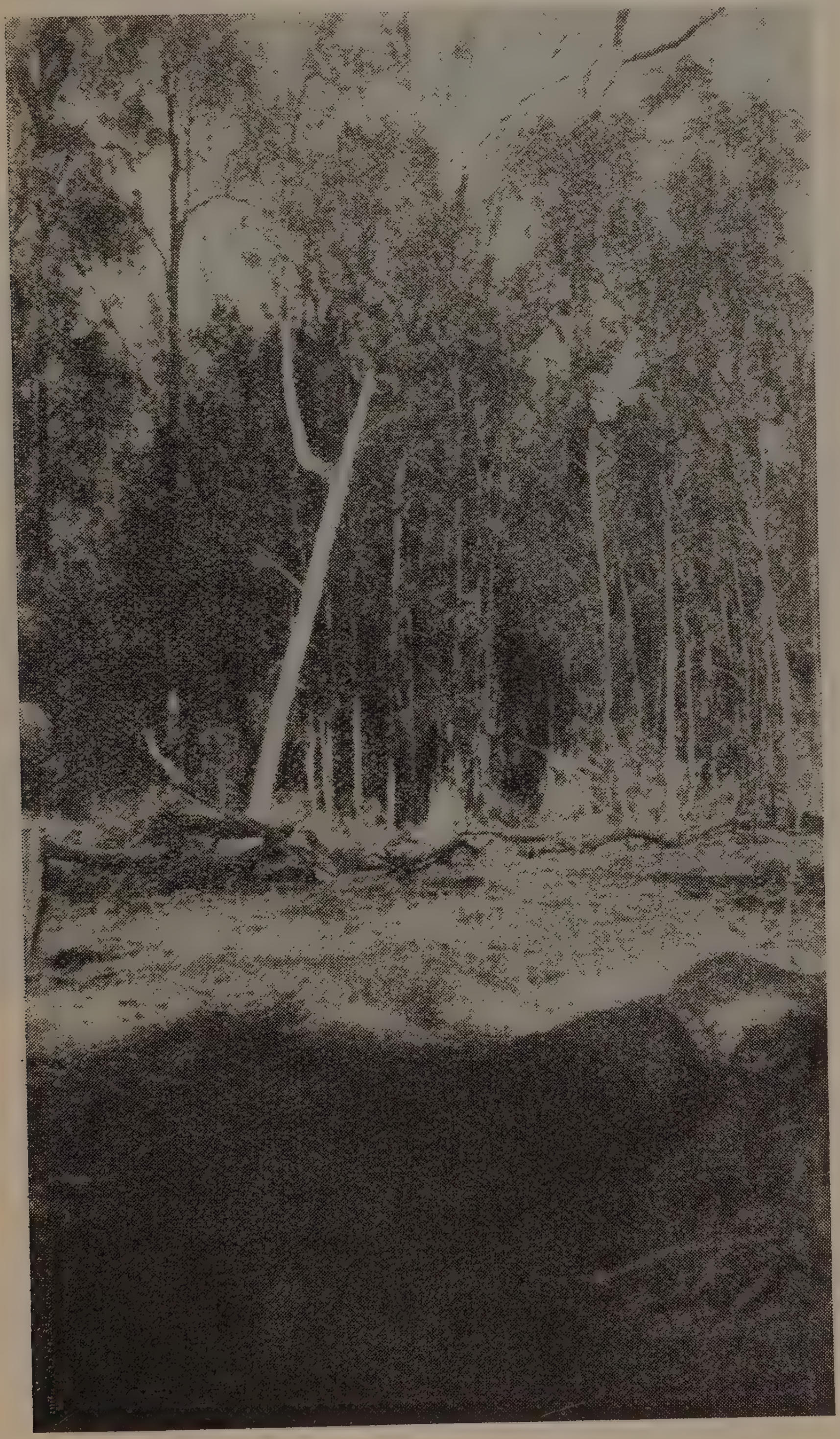


Plate 187.

TYPICAL BRIGALOW AND BELAH COUNTRY.

The outstanding feature, however, which has impressed us most is this: On the improved brigalow and belah country, as one dry spell succeeds another, stock manage to keep condition, not merely exist, in spite of the deficient rainfall. We are not over-stocked, nor are we under-stocked. What are the qualities of this soil that enable brigalow and belah country to weather drought, and often produce a green bite, while the rest of our country is getting brown?

To try and find the answer to that question was the starting point of our soil experiments. We shall now describe how we put the question to Nature.

ARRANGEMENT OF EXPERIMENT.

Holes were sunk in the soil to different depths down to three feet, although the present experiments were confined to

(*a*) The soil on the surface;
(*b*) The soil at 6 inches below the surface;
(*c*) The soil at 12 inches below the surface.

Plate 188.

A CLEARING PROBLEM.

The bringing of Brigalow country into production is not such a formidable task as it appears at first sight. Ringbarking, poisoning with arsenic pentoxide, and the fire stick are the usual means employed.

The soil on the surface was smooth; it began to get crumbly or rather lumpy the deeper we went. After many months of westerly wind and no rain it looked bone dry. At 9 to 12 inches the small lumps showed here and there a white surface as of chalk. This was probably due to the presence of lime. The importance of this will become apparent later on.

Samples of soil were taken from each level—surface, 6 inches and 12 inches—wrapped in brown paper and taken to the homestead. We did not have the resources of a well-equipped laboratory there, but worked with the means at hand, such as they were. The soil was crushed and evened up with a rolling-pin. To make the mesh of the soil equal in each experiment, a sieve was required. A gravy colander was found to answer the purpose, and was requisitioned from the kitchen.

We had purchased a number of rain gauges, which with their graduated facing, permit of reading any change in the level of their contents; 72 cc. of each sample of soil were placed into each gauge, filling them up to the line marking 15 points. An equal quantity of rain water was subsequently added, and the results noted and tabulated in the record.

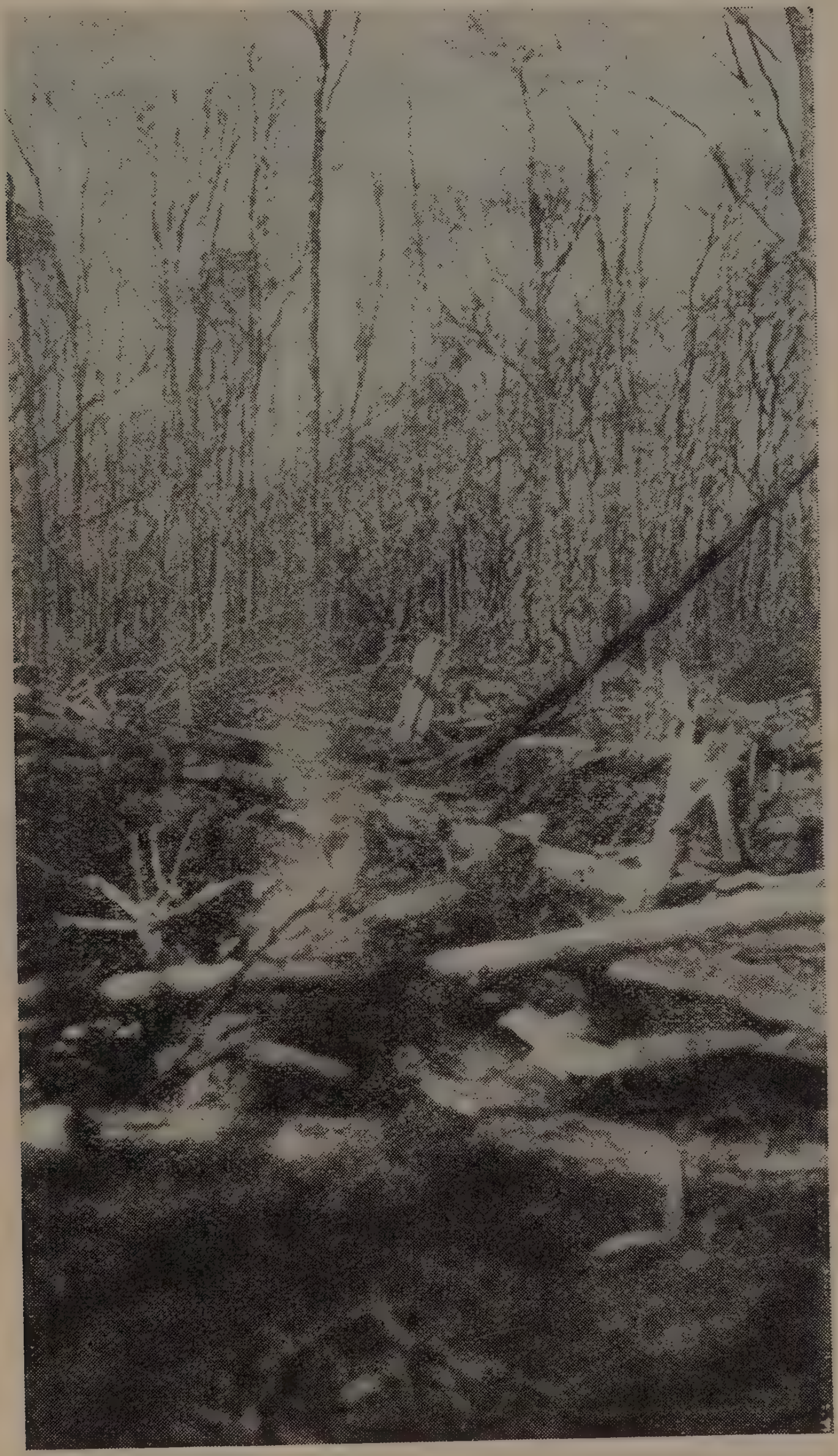


Plate 189.

A BRIGALOW FALLING ''IN THE ROUGH.''

A tangle of logs covering ''melon-holey'' ground, which, before long, will be clothed with nutritious indigenous and introduced pasture grasses.

What happens in a rain gauge one and a half-inch in diameter and filled with soil artificially powdered probably differs vastly from what happens in the earth under natural conditions. This difference has always been kept in mind when interpreting the results of the experiment.

The Soil Breathes.

When a lump of sugar is dropped into a cup of hot tea, bubbles rise to the surface, as the air imprisoned within the sugar is set free. Precisely the same thing happens, when water is added to the soil in our gauges. The water as it soaks into the soil expels the air from within the soil and forces it up in bubbles. The surface soil holds more air—nearly half its volume—the deeper layers less.

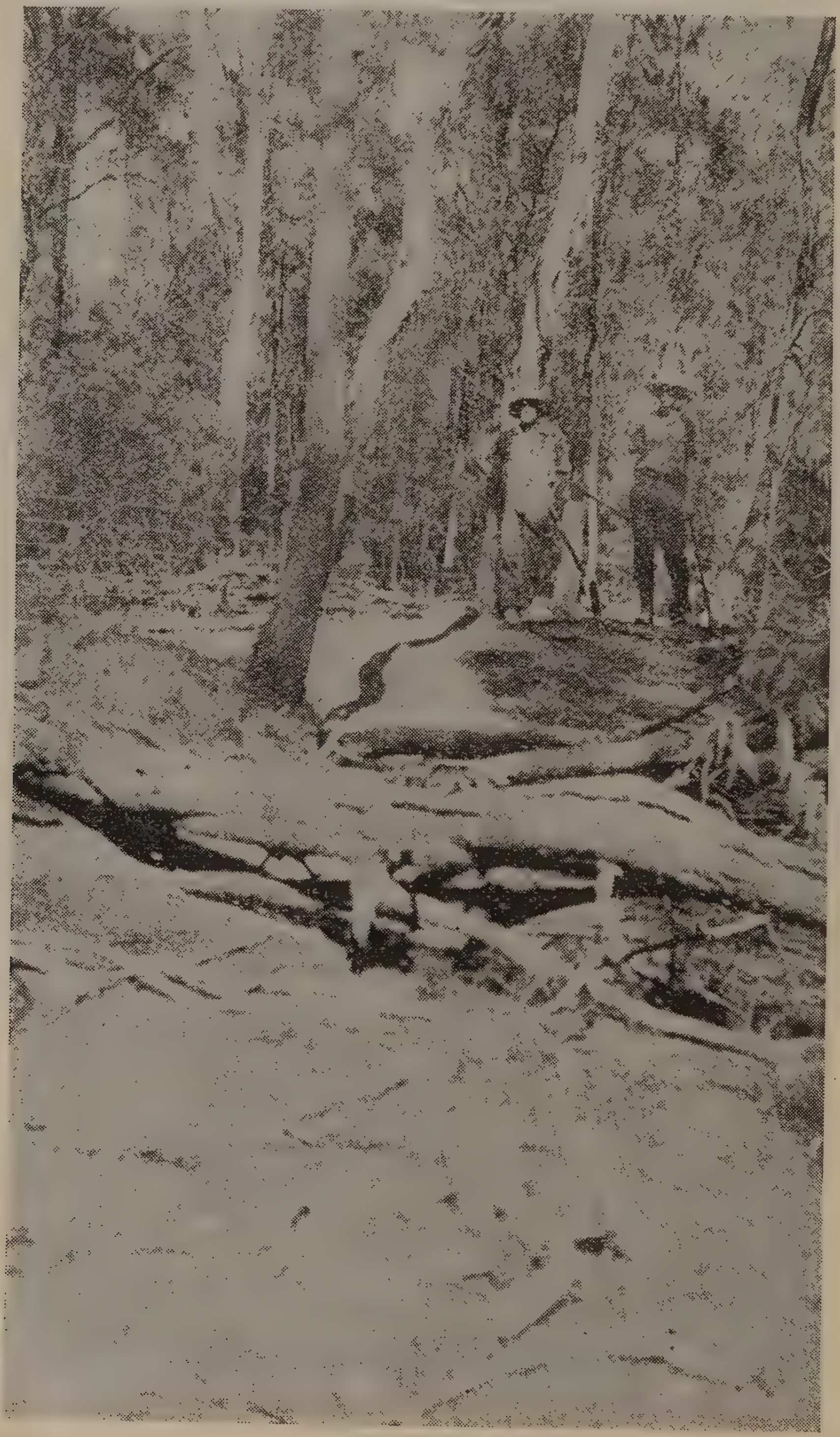


Plate 190.

A LARGE MELON-HOLE ALMOST HIDDEN BY SCRUB DEBRIS.

As in the gauges, so in Nature. As the rain falls, the infiltrating water drives out air and gases from the soil, in which they had lodged. Everyone knows the smell of moist earth after a shower. The gases displaced from the soil by the rain may give rise to this smell.

How does the air get into the soil? We know, of course, that without air in the soil plant-life would not be possible. When the wind raises clouds of dust it leaves behind air in the surface layers in exchange for the particles of soil it has blown away. Yet it is hard to imagine how this air reaches the deeper layers. Gases, without a doubt, form in the soil itself. The earth is full of life: animal, plant and bacterial. Life gives place to decay, decay gives place to life. Carbonic acid and other gases are thus formed and held captive within the earth. But the bulk of the air, especially oxygen, must come from the atmosphere.

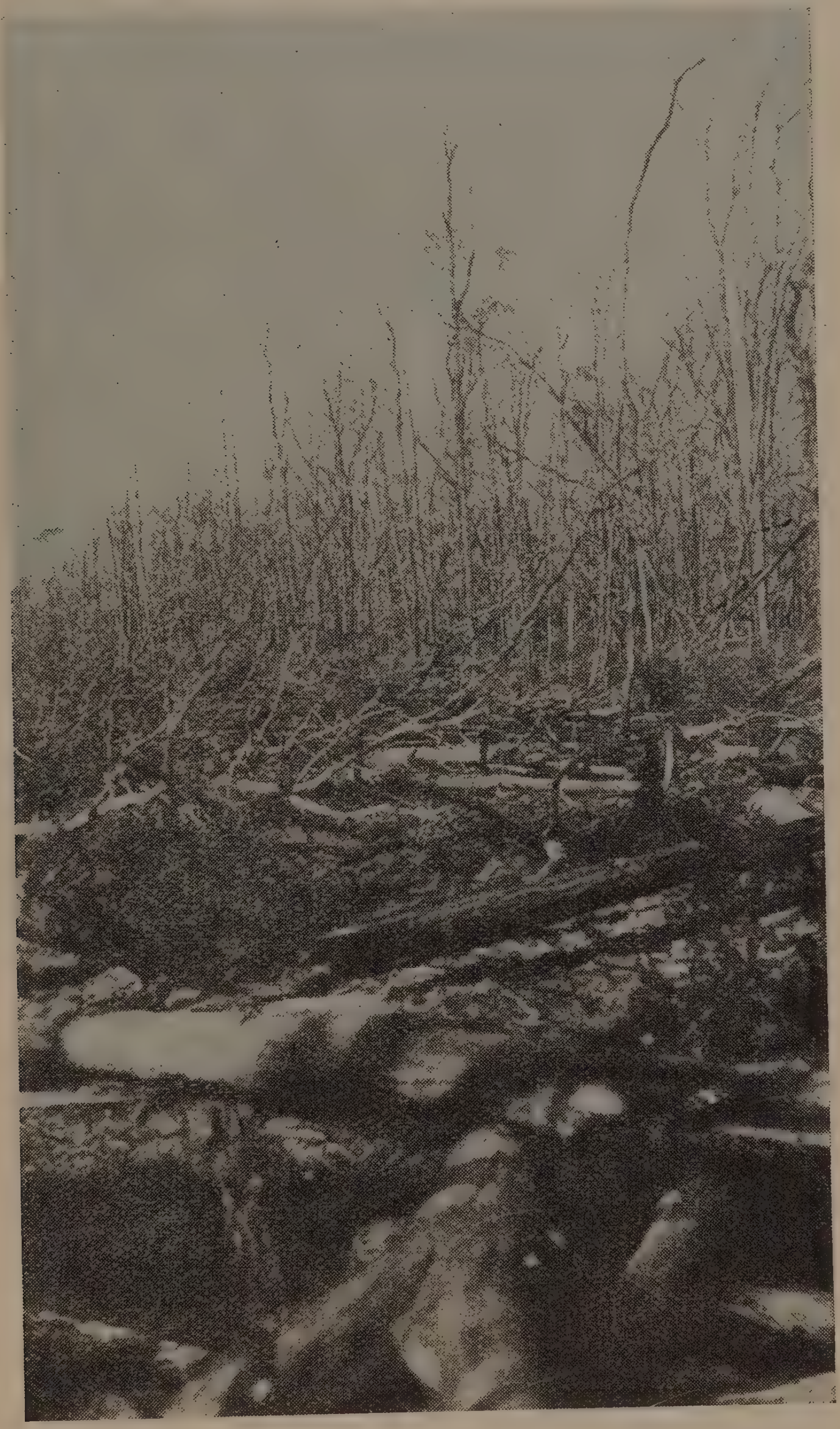


Plate 191.
A FENCE-LINE CLEARING.
Note melon-holes in the foreground.

It was not our gauges, but the observations in the paddocks, which supplied the answer as to the origin of air in our soil.

The soil shrinks in dry weather and develops cracks. These cracks are mostly found in the heavy black soil of the Darling Downs, the western plains and the brigalow and belah country, wherever there is a heavy clayey subsoil.

The man on the land hates these cracks; they are unsightly, a hindrance to agricultural operations; they are credited with preventing the growth of trees by tearing their roots, and are always associated in his mind with droughts.

Plate 192.

A SUBDIVISIONAL BOUNDARY CLEARED FOR FENCING.

Yet, we cannot escape the conclusion that these cracks are absolutely necessary for the well-being of the soil. Through them the atmosphere gains access deep down to portions of the soil, which otherwise could never be ventilated; the air breaks up the soil into lumps, crumbles and weathers it. Apart from the many huge cracks, there are found all over the country minute cracks which serve the same purpose in a smaller way.

When the rain comes the water pours down these cracks following the channels which the dry season had formed for it. Thus the rain saturates the soil from above and below. The water drives out the excess of air, although much air may be imprisoned by the rapid swelling of the soil.

Plate 193.

A DOG-PROOF NETTING FENCE IS A NECESSITY IN BRIGALOW COUNTRY.

In dry weather the soil breathes in air; in wet weather the soil breathes out air.

Droughts and dry spells in the West are not unmitigated evils; they really are factors that cannot be done without. And Nature takes care that they are not done without. The liberal aëration of the soil during a drought by means of the cracks creates conditions most favourable for growth as soon as the rain comes. This is probably one of the reasons why droughts are followed by bountiful seasons, despite the fact that so many of the roots must have been eaten out by the sheep, and many of the seedgrains swept away by the fierce westerly winds.

So, after all, we have to be thankful for what the dry spell does for our Western country. Let us count our blessings even during a drought.

THE SOIL EXPANDS.

We added in the gauges an equal volume of rain water to an equal volume of soil—

1. The soil from the surface swelled out by 20 per cent. (one-fifth);
2. The soil 6 inches below surface swelled out by 27 per cent. (one-fourth);
3. The soil 12 inches below surface swelled out by 33 per cent. (one-third).

Plate 194.

THE REALISATION OF A BOUNDARY RIDER'S DREAM.

The cleared track alongside the dingo- and vermin-proof fence serves as a firebreak as well as making boundary maintenance easier.

These are startling figures. That the subsoil should expand by one-fourth to one-third when thoroughly wetted appears almost unbelievable; we seem to lose the solid ground beneath our feet. Again let us remember that the earth is not encased in a gauge 8 inches high, with glass walls and glass bottom. *Before we accept such figures, we must go back to what we see in the paddocks under natural conditions.*

Two years ago, in December, 1934, after a lengthy dry spell, we had 1,116 points within ten days. It was the biggest rainfall within so short a time since we had been on Bybera. Fences were washed out, all the cracks filled up, and numerous green belahs, green pines, and an enormous ironbark were uprooted. Bybera is not hilly country, it looks almost level; but measured by the altimeter there is a difference of, at most, 40 feet between the highest and lowest point. So we cannot speak of a hillside erosion.

Plate 195.

ON THE EDGE OF THE CLEARING.

The filling up of the cracks supplies, we submit, the certain proof that the soil swells out after rain. Washing out of fences in level country seems most unlikely to anyone knowing the gluey nature of the brigalow and belah subsoil. What really took place was that the fence-posts were partly squeezed out by the expansion of the soil and the running water may have done the rest.

It seems an extraordinary thing that a storm should have the power of uprooting green trees, especially in the West, where scanty foliage offers less leverage to the wind. Of course, brigalow and belah are shallow-rooted trees with surface anchorage; but not so the ironbark. What probably happens is this: During a dry spell, the soil shrinks and cracks, and in doing so snaps some of the tree roots. This may not always interfere with the well-being of the tree, but it certainly means that some of the *"moorings"* are slipped. Hence the tree is less able to resist the force of the wind, especially after wet weather, when the swelling of soil has loosened its texture.

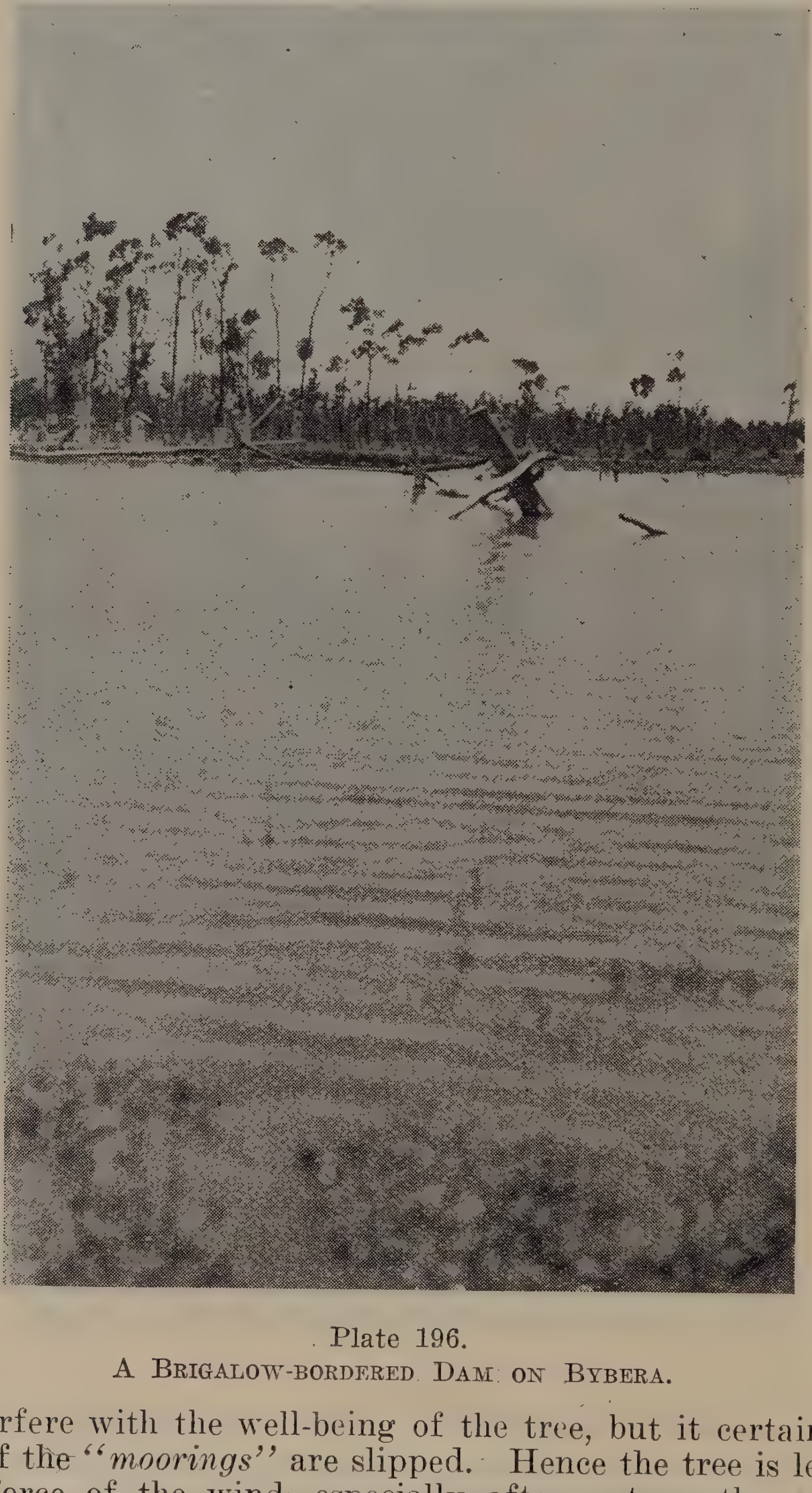


Plate 196.
A BRIGALOW-BORDERED DAM ON BYBERA.

Another proof of the expansion of the soil is furnished by the melon holes. We who live in this melon-holey country are faced all the time with the problems of this peculiar formation. It is the hole that at first takes everybody's eye and imagination. But we found on some, especially the larger holes, a marked buckling of the rim of the hole and a gentle sloping of this rim towards the level country on the far side. This seems to prove that in the making of these melon holes both shrinking and buckling of the soil are definite factors. There is another significant fact which bears out what we have just said. Most of the fallen timber in the brigalow and belah country is found around the melon holes, which are generally bridged by trees which have fallen across them. Evidently the shrinking and buckling of the soil have done their share in loosening the root-hold of the trees standing close to the melon holes.

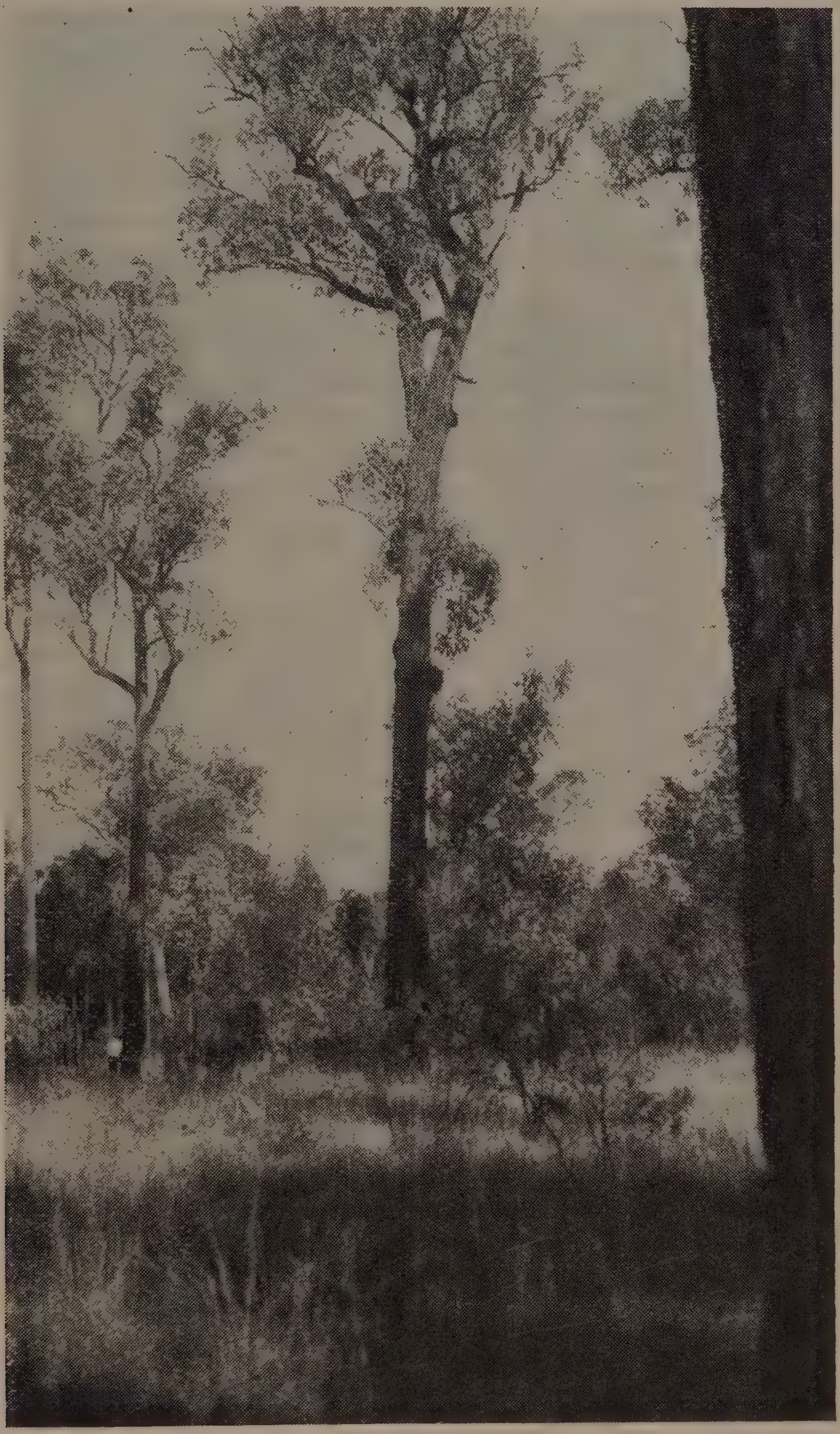


Plate 197.

AN "OLD MAN" IRONBARK ADDS TO THE PICTURESQUENESS OF A PARK-LIKE LAND.

There can be no doubt that in the brigalow and belah country shrinkage is followed by expansion, expansion is followed by shrinkage. The soil does not stand still, but is constantly moving under the influence of the changing conditions of the weather. What happens in the paddock under natural conditions confirms the trend of our experiments, though perhaps not the extent by which the soil in the gauges swells and shrinks. The main value of the experiments lies in the fact that we have been able to establish that the soils of different levels have different rates of expansion and shrinkage.

The Soil Stores Water and Minerals.

Returning to our experiments in the gauges.—We had added more water to the samples of the different soils than these soils were capable of taking up. The surplus water was left standing on top of each sample. The appearance of the water differed with the depth of the soil from which each sample was taken. The water above the surface-soil cleared fairly quickly. The water above the samples of subsoil looked cloudy to muddy, until finally a thin film settled on the six-inch specimen and a thicker film on the soil taken from the 12-inch depth.

These films consisted of colloidal matter, and these colloids had come from the soil. As they wield such a great influence on the productivity of our western soils a brief explanation is needed.

A piece of glue when steeped in cold water takes up a lot of the moisture and swells up to great proportions. The Greek word for glue is kolla. Hence these substances which absorb water and other materials and then become sticky were named colloids or gluelike. Colloidal matter like glue when dry shows little of its stickiness; but when brought in contact with water the stickiness soon appears.

These colloids or gluelike substances are of enormous importance in Nature; both in plant and animal life. Without them life could be carried on as little as an engine could continue to run without oil. The sticky nature of our blood is due to colloids, which keep the blood corpuscles in suspension, floating about in the blood stream. But for these colloids there would be friction everywhere. They have, however, other functions as well.

It is perhaps not quite correct to say that colloids are restricted to animal and plant life. Certain minerals are also of colloidal nature, *but these minerals require protection by plant colloids to keep them in the proper colloidal state.*

The most common example of a mineral colloid is clay. On account of its colloid nature, clay when damp becomes sticky, and can be moulded by the potter. Anyone driving over black soil roads in wet weather knows the stickiness of clay clinging to the wheels. Roads are not passable till the clay has dried and become again a dry colloid. But the clay, even on the surface, holds water ever so much longer than sandy country, which is deficient in colloids. The deeper layers of black soil shielded as they are from exposure and evaporation retain their moisture longer.

The clayey subsoil, on account of its colloidal nature, is capable of holding water for a long time.

How is it that clayey soil will hold water long after the ordinary soil has parted with it? The clayey subsoil consists of a mass of fine particles surrounded by a thin film. These films act like a bladder as soon as the soil is wetted. They admit the water while the soil is dry, and prevent its escape as soon as it is wet. They are of the same nature as the films we saw rise to the surface in the gauges.

The colloidal subsoil parts with its moisture but slowly, even when close to the surface. But plants that send their roots down to the subsoil are capable of profiting by it. Digging up Mitchell grass roots three or four feet deep is a tedious business. The soil closely adheres to the roots. The soil sticks to the root-fibres in the form of lumpy rings, which are arranged on the fibre almost like beads on a rosary. One could see how the roots had burrowed their way into the subsoil. Roots secrete carbonic acid which dissolves and pierces the film till they are free to enter and plunder the store of water, minerals, and humus laid up within.

Now vision the dense brigalow and belah country. It is an old and long untroubled land. In its virgin state this country will carry barely one beast to fifty acres. Day by day, and year by year, the leaves are falling to the ground mouldering and setting free humus and their rich mineral contents. Trees crash down and decay, enriching the earth. Now comes the rain. A heavy downpour forces water, minerals, and humus into the clayey subsoil, where they remain stored. *Thus is added that much-needed protection of organic matter which is required to keep the colloidal clay in its proper condition.*

At a depth of nine to twelve inches below the surface we found lumps of the clayey subsoil coated here and there with white chalk—carbonate of lime—which perhaps ages ago had been part of the brigalow leaves. The lime in which this country abounds is of great value; it *renders the colloidal film more resistant. Thus the brigalow and belah subsoil becomes the storehouse of water, minerals, and humus, and will continue to show green shoots of grasses long after they have vanished from the rest of the country.*

Conclusion.

Now to the practical application of the foregoing.

The brigalow and belah soil conserves moisture longer than any other country, owing to the peculiar colloidal condition of its subsoil. Of that we have ample proof. What we do not know is this: If this soil is cultivated, how deep should it be ploughed so as not to interfere with the colloidal subsoil? Only field experience can tell us.

We have proved that lucerne and prairie, Mitchell and Flinders grasses thrive on Bybera. We have never tried any cereal crop, yet the depth to which the ground ought to be ploughed is a matter that urgently requires settling. We may destroy the water-holding capacity of the colloidal subsoil by breaking it up too deeply.

The planting of lucerne and prairie grass by the grazier and dairy farmer offers great prospects. Prairie has the great advantage of being a winter grass. On Bybera it lasted longer during the drought than any other grass in the winter months. The planting of prairie and lucerne would secure feed during the winter months, and, possibly, *a continuing supply of baby beef for export.* But the burning question remains, *how deep ought we to go down in cultivating the land.*

Only the field experiment on a comparatively large scale can tell.

Fifteen to twenty million of acres of brigalow and belah country are estimated to exist in Queensland. A new kingdom waits to be conquered.

Agricultural Notes

Cotton.

The favourable climatic conditions which were reported as ruling throughout all districts during April have continued through May, with the result that the cotton crops have been harvested rapidly, and excellent grades have been obtained. The volume of cotton received at the Glenmore Ginnery was so great during the early part of May that it was necessary to forward several train-loads to the Whinstanes Ginnery. An analysis of the grades of cotton being obtained at both ginneries indicates that not only is the average of the cotton of decidedly better quality than was the case during the corresponding period of last year, but there is definitely less spotting, which has resulted in a markedly higher percentage of the cotton going into the mature grades.

Although the dry conditions favoured the obtaining of cotton of high grades, the development of the top crop has been severely retarded, so that it is obvious many areas will produce only a very light top crop, if one at all. The result will be a marked reduction in the total crop that will be obtained for this season compared with what was anticipated following on the March rains.

The yields that are being obtained by farmers who have planted on newly broken up grassland indicate, however, the marked benefit that is realised where this practice is followed. In every district farmers on all types of soil are obtaining satisfactory yields from plantings even as late as mid-December on grassland in its first or second year of cultivation, whereas adjacent cotton crops on cultivations of four or more years of age are producing extremely low yields. On the average it appears that a conservative estimate of the benefit being realised by planting on grassland in its first or second year of cultivation will be at least 50 per cent. gain, and in many instances as much as 100 per cent. gain, except in the case of extremely late planted cotton. Many crops on old land will not produce 300 lb. of seed cotton per acre, whereas adjacent crops in the first year following grassland are producing as much as 700 lb. per acre, and in a few outstanding instances around 1,000 lb. Undoubtedly all cotton growers should practise the grassland-cotton rotation, especially as the newly-sown grass paddocks on the old cotton cultivations have given clearcut evidence this season of producing heavier yields of grass, and of greater feed value, than have adjacent old grass paddocks. As most cotton growers practise dairying as well, the grassland-cotton rotation is of marked assistance to them in their two major industries.

Sugar.

Weather conditions for the month of May were not at all favourable for cane growth; warm and cool weather alternated, but no beneficial rains were received in any area.

It now seems certain that the provisional estimate of a month ago must be substantially modified. This is particularly true for the Central and Southern areas. A more accurate forecast will be available in the course of a week or two.

STACKING SILAGE.

The best results are obtained by building stacks at the latter end of summer, when suitable crops such as maize and sorghums are available, and using the silage during the winter or spring months. Stack silage is not intended to last indefinitely, although it has been known to keep for several years in a well-built stack without serious deterioration. The essential points to observe in stack silage building will therefore be of interest.

The site should be naturally drained and, where possible, close to the crop, the dimensions of the base being estimated on a basis of 54 cubic feet to the ton, allowing for a height of 15 feet in the completed stack. Shallow drains are then opened around the site, using the earth removed for levelling off. For a rectangular stack, a framework is constructed 15 feet high, using poles 17 feet 6 inches long and 5 to 6 inches in diameter at the butts. The poles should be placed 2 feet in the ground at intervals of 3 feet. An extra pair of uprights is erected 1 foot from each end of the stack framework to hold the crosspieces which support the ends of the fodder before trimming. The framework is braced on all sides, in addition to the top centre, twitching securely close to the top of the uprights.

For hand work it is convenient to construct a whip hoist, using a clamp to prevent slipping at the point of suspension.

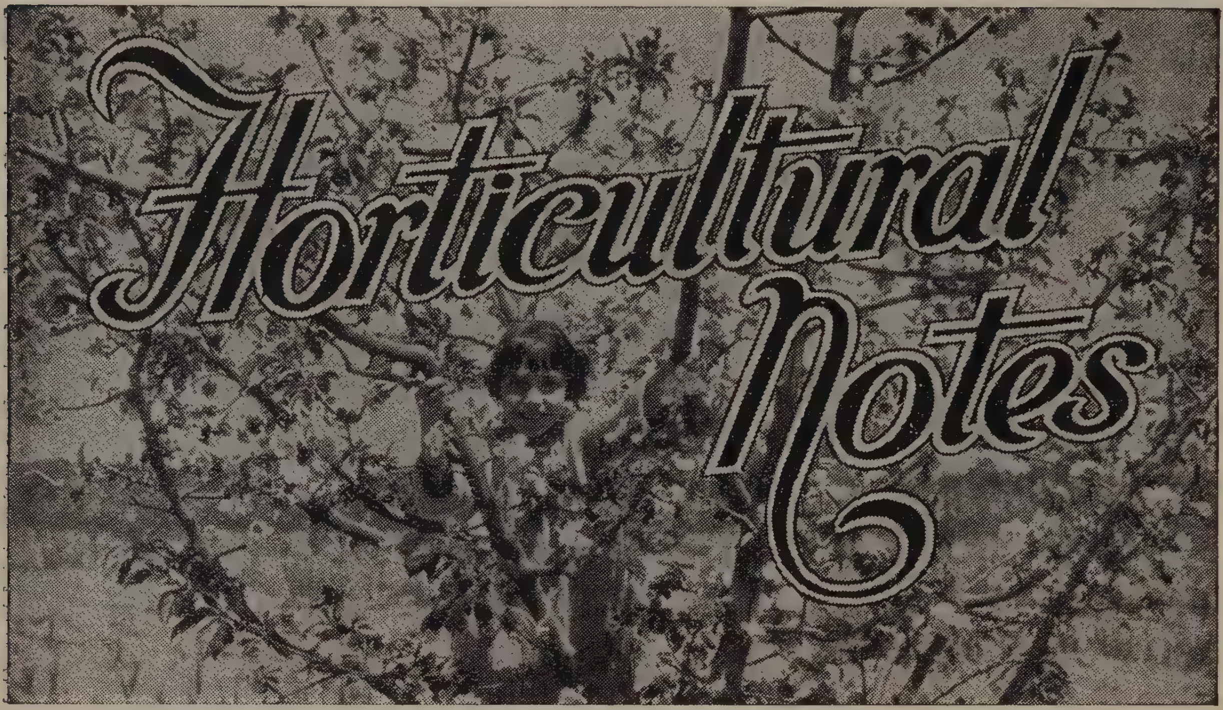
Before stacking, place a 1-foot to 2-foot covering of waste green grass on the ground as a foundation, stacking thereon, keeping all the stalks laid lengthwise with the stack. Load from alternate sides each day, placing the ends of the fodder well over the supports, reversing heads and butts with each layer.

As stacking proceeds, a board is placed flush with the stack end uprights, trimming off surplus fodder and throwing it back on to the top of the stack, taking care to see that no crossing of stalks occurs.

After the first two days, stack a minimum of 2 feet 6 inches each day, keeping the centre high, as heating soon causes the silage to settle. The layers are stacked so as to avoid bumps, placing fairly straight stalks along the sides, then firming down and joining heads or butts at the posts. After each day's work weighted wires are placed over the stack to assist the settling.

When finished to a full camber, a layer of soft green grass is placed on top and watered well, after which the framework of logs holding the weighting material can be placed in position. If earth is utilised, a minimum thickness of 1 foot should be used on top of the stack, topping off with bush hay held by weighted wires.

—*H. W. Ball.*



Celery Growing.

H. BARNES, Director of Fruit Culture.

CELERY is classed as a cool climate crop, and it is probably mainly on this account that Queensland orchardists have never given it serious consideration. It is a crop also which demands very exacting care and attention to detail. Increasing quantities of celery, chiefly grown in South Australia, are being used in Queensland, and there appear to be prospects of producing at least a portion of local requirements on alluvial flats in the Stanthorpe district.

In the *Journal of The Department of Agriculture of South Australia* for January, 1937,* and in the *New South Wales Agricultural Gazette* for April and May, 1937,† appeared articles on celery growing in those States, and the following information is largely extracted from those articles. The blocks also have been kindly loaned by the South Australian Department of Agriculture, and copies have been made of illustrations in the New South Wales Agricultural Gazette.

"Celery, known botanically as *Apium graveolens* (Linn), is indigenous to Britain, Europe, and the temperate parts of Western Asia, Africa, California, and New Zealand; the garden form has been grown by the French since the seventeenth century."

"From the indigenous types, modern delectable strains have been raised, and today are used for salads, soups, and as a cooked vegetable. The edible portion is the enlarged leaf stalk, this stalk usually being bleached white by exclusion of the sunlight."

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* "Celery Growing," by N. R. Quinn, Assistant Horticultural Adviser, Jour. Dept. Agric. South Aust., Vol. XL., No. 6, Jan., 1937.

† "Grow Celery for the Sydney Market," by John Douglass, H.D.A., H.D.D., Senior Agricultural Instructor, The Agric. Gaz. of N.S.W., Vol. XLVIII., Parts 4 and 5, April-May, 1937.

SOIL.

"The greater portion of the celery produced in South Australia is grown on the Adelaide Plains within 10 miles of the capital, where the crop does well on all types of soils, comprising deep red sand in the western district, alluvial silt on the banks of the River Torrens, chocolate loam overlying a stiff red clay, and the stiff black Bay of Biscay soil at the foothills of the Mount Lofty Ranges."

For the guidance of Queensland growers, it is emphasised that the soil should be very rich, particularly in organic matter, and a good supply of water for irrigation should be available.

In the United States, where celery growing has assumed enormous proportions, practically the whole of the crop is produced on reclaimed swamp lands, which are composed almost wholly of decayed organic matter.

Plate 198.
Selected celery heads for seed.
[*Photo.: E. W. Pritchard, S.A. Jour. Ag.*

CLIMATE.

"The climatic conditions on the Adelaide Plains are regarded as being most favourable to the growth of celery—warm sunny days with low humidity being frequent during the growing period."

SEED.

Seed selection plays an important part in the celery industry in South Australia. "A majority of prominent growers have by careful selection of seed built up strains of their own which are not obtainable from seedsmen. The usual method of selecting seed is to mark well-shaped and vigorous plants in the field at the time of harvesting. When convenient, these selected plants are transplanted to a place in the garden where they will not be disturbed until the seed has matured in January or February. Seed matures too late for use in the following year's crop and two years supply is usually kept in hand. The plants selected for supply of seed should be sprayed consistently to reduce 'Leaf Spot' infection. When the seed has matured, it should be thoroughly dried by spreading on canvas sheets, and when dry placed in airtight containers until required. Owing to the possibility of carry-over of Leaf Spot on seed, it is a good practice to disinfect the seed in some manner. One method of disinfection is known as the hot water treatment."

Hot Water Treatment for Disinfection.

"The required amount of seed for the season's planting is placed in a muslin bag and submerged for ten minutes in a large vessel containing water heated to a temperature of 136 deg. F. (The maintenance of the temperature is very important.) After removal from the hot water the seed is placed in cold water for two minutes. Seed intended for planting at some future date should be thoroughly dried prior to storing. The hot water treatment has been reported to retard, and also reduce the germination slightly. (J. C. Niell, N.Z. Journal of Agriculture, vol. 46, page 289.)"

"There are approximately 60,000 seeds in an ounce of celery seed, and approximately 75 per cent. is usually germinable."

Plate 199.
The seed-bed.

[*Photo.: E. W. Pritchard, S.A. Jour. Ag.*

The Seed-bed.

"Fresh soil of an open textured nature should be used if possible for the seed-bed in order to avoid trouble with root fungus diseases such as 'damping off.' The seed-bed should be thoroughly prepared by working in heavy applications of decayed organic matter several weeks before the time of planting the seed. The bed should be kept well watered to permit weed seeds to germinate, and be periodically forked over, reducing the soil to a fine tilth. If it is not possible to use fresh soil for the bed, partial sterilization may be achieved by treating the soil with a solution of formalin consisting of 1 pint of formalin in 6 gallons of water, distributed evenly over 24 square feet. This method will prove more effective if bags saturated with the solution are placed over the treated seed-bed to retain the active fumes. The bed should remain thus covered for forty-eight hours, and sowing of the seed should not take place until all fumes have disappeared after several days. Dissipation of the gas may be hastened by loosening the surface of the treated bed."

When completed, the soil in the seed-bed should have been worked down very finely.

Sowing the Seed.

"The difficulty of sowing such fine seed evenly over the bed may be overcome by mixing it with whiting or by sprinkling it with an ordinary household pepper-pot. When the seed is evenly distributed over the seed-bed, it is covered very lightly, first, with fine soil, and then with a mulch of stable manure. Watering should be carried out daily during dry periods."

"First seedings in South Australia take place during September and October, and extend into January and February in order to make provision for a continuous supply of seedlings. During the growing period the seedlings must be weeded and sprayed with 6:4:50 Bordeaux Mixture. When the seedlings are from eight to ten weeks old, the tops are cut back and the tap roots are cut before planting out in the field." (N. R. Quinn S.A. Journal of Agriculture.)

Outlining the conditions in New South Wales where a first seeding is made in August, Douglass† recommends that the seed be planted in shallow furrows, spaced 6 inches apart. These furrows are ¼-inch deep, and are made by pressing the edge of a board into the soil. The board is flopped over on its other edge for the next furrow. If the board is 6 inches wide, the furrows will be spaced correctly. The seed, after being sown thinly, is then covered by dragging the edge of the planting board across the bed, and the soil is then firmed over the furrows by pressing it with the flat of the board. The bed is watered thoroughly with a fine spray, and then mulched with rotted manure. If the weather is fine it is then watered each morning to assure a supply of moisture in the surface soil. "Germination will take place in one week during warm weather, and up to three and a-half weeks in frosty weather.

Some growers place light hessian covers over the beds in hot weather to protect the plants from sun scald. It is much better practice, however, to irrigate regularly, even twice daily, and grow hardy seedlings in the sun, than to risk soft, cover-grown seedlings, which may be destroyed by hot weather at a later date.

Should the seed come up thickly in the beds, the plants should be thinned out. In the United States the growers prick out the seedlings into other beds in order to obtain sturdy plants suitable for transplanting. The furrow or row method of sowing the seed does away with this operation.

PREPARATION OF THE LAND AND MANURING.

Several textbooks on the subject of celery-growing refer to the necessity for heavy applications of rotted animal manure—up to 25 tons per acre—to the land. In New South Wales, poultry manure is regarded as good for this crop in heavy soils, although equal parts of poultry and cow manure are more suitable for open textured soils.

It is realised that growers may find some difficulty in obtaining sufficient supplies of animal manures, and in this event the land should be enriched in organic matter by growing and turning under bulky green cover crops. The Queensland Agricultural Chemist refers to the necessity of using large quantities of well-rotted stable manure, and, in addition, the use of a heavy dressing of an artificial fertiliser of the formula 4:8:10, using about 6 cwt. per acre previous to planting out, and two or three top dressings of 1 cwt. each; or instead of the ready-mixed fertiliser, the following mixture may be used with advantage, per acre:—

2 cwt. sulphate of ammonia,
3 cwt. Nauru phosphate-superphosphate mixture,
1½ cwt. muriate of potash,

at the time of planting, followed by two top dressings with a mixture per acre of

1 cwt. nitrate of soda,
1 cwt. superphosphate,
½ cwt. muriate of potash.

Plate 200.
Celery planted out in the field in double rows.
[*Photo.: E. W. Pritchard, S.A. Jour. Ag.*

In South Australia it is advised that, in addition to the basal dressing of 20 to 25 tons of stable manure, the young seedlings require dressings of some nitrogenous artificial manure from time to time. The gardener has to use his experience in this matter, and no definite programme can be set down. Celery is a voracious feeder, as can be seen from the large number of feeding roots that develop from a healthy vigorous plant. The usual dressings of nitrogenous fertiliser are from 3 to 4 cwts. of sulphate of ammonia per acre. This is distributed along the rows as close as possible to the rooting system, lightly hoed in, and followed by an irrigation. The growth of the celery plants after replacement in the field should never receive a check as a result of insufficient moisture or plant food.

Planting.

The seedlings are large enough to plant when 4 inches high, the tap root being removed and the tops cut back before setting out. If the soil is inclined to dryness at the time of planting, the seedlings should be watered as soon as possible after placing.

Some difference of opinion exists in regard to the best method of planting. In South Australia the double row system of planting is most commonly used, and is as follows:—The seedlings are set in the soil with a "dibber," and are placed 10 inches apart in double rows also 10 inches apart. The seedlings are not placed directly opposite each other in the double rows, but are staggered. The double rows are spaced 3 feet apart in the field. This system of planting necessitates approximately 26,000 plants per acre. The double rows of plants are set out in a shallow furrow to facilitate irrigation.

Plate 201.
The method of planting celery in single rows.
—*N.S.W. Ag. Gaz.*

In New South Wales, it is contended that, in that State, double-row planting is responsible for poor ventilation between the rows, encouraging the development of both fungous and bacterial diseases and leading to the production of much second-grade celery. Single-row planting is recommended for preference. The seedlings are set out in rows spaced 3 feet apart, the plants being spaced 6 to 8 inchs apart in the rows. The drills should be struck out and 4 cwt. of superphosphate and 2 cwt. of sulphate of ammonia per acre worked into the soil. If irrigation is available, it is advisable to run water down the drill before setting the plants out. The seedlings are usually set into the mud no deeper than 2 to 3 inches below the original soil level. The objection to deep planting lies in the danger of the plants being destroyed by disease, which attacks the stem and heart when covered with soil. It is a mistake to trench celery in this country.

Cultivation.

Once the young seedlings have been planted it is upon subsequent cultivation and care that the success of the crop depends. The plants must be kept growing vigorously all the time. A stoppage of growth, due to lack of moisture or other cause, is liable to result in hollow stems, pithiness, premature seed formation, loss of quality, and excessive stringiness. Regular watering, therefore, is of the greatest importance in fine weather.

Furrow irrigation is considered preferable to overhead spraying. In New South Wales, in the early stages of growth, flooding three times weekly is advocated during fine weather; and, in the later stages of growth, it is absolutely necessary to water twice a week to maintain quality. It is stated by Douglass that the ideal practice is to make a water furrow right down the rows close to the plants in the early stages of growth. As the plants develop the furrow can be re-made until it is out in the middle of the land between the rows of plants. This method not only encourages the spread of the roots, but also enables the farmer to cultivate between the rows, thus creating a dusty, dry mulch which is an advantage. Single-row planting and the furrow method of watering a crop allows the grower most effectively to spread and work fertiliser into the soil.

Plate 202.
Celery "Boarded-up."

[*Block: S.A. Jour. Ag.*

BLANCHING.

Celery is approximately a five months crop. When it is about three weeks from maturity, the light should be excluded from the leaf stalk in order to effect blanching. The old method of hilling up the soil round the stalks is not now practiced. The usual method is to place light-proof boards on each side of the rows. The boards are pressed in tightly against the plants and held in position by stakes driven into the soil. Sometimes sheets of corrugated galvanised iron are used, the sheets being cut in half lengthwise. New South Wales experience of galvanised iron, however, is that in that State it is too heating, and causes physiological defects as well as encouraging fungous and bacterial diseases.

The board method is recommended as likely to be most suitable for Queensland. Boards should be about 12 inches wide and 12 feet long, and may be made of old or second-class timber. Widths of less than 12 inches may be nailed together with laths. The method of fixing the boards is described in New South Wales as follows:—"Lay the boards flat on either side of the plant rows, force the inside edge against the plants and then raise to a vertical position, bringing up all outside leaves and trash. The boards, which are then parallel with the celery between them, are kept in position by means of a wire clip or short stake. Tarred paper is also extensively used for blanching and has proved fairly satisfactory."

Plate 203.
Celery blanched with boards, N.S.W.
N.S W. Ag. Gaz.

Following boarding, the practice is to apply a dressing of nitrogenous fertiliser such as nitrate of soda between the rows and to water heavily every three days. It will be found that the nitrogen and the water force the heart leaves and stems up through the boards which exclude the light and produce the blanched effect.

The celery is usually boarded up for two or three weeks, the vigour of the plant at the time of planting governing the actual period. If the plants are boarded up for a longer period, the stalks become pithy and greatly reduce the quality of the product. It will thus be noted that only the quantity of plants which can be marketed each week should be boarded up at one time. The following week another lot of the plants

Plate 204.
Harvesting celery.
[Block: S.A. Jour. Ag.

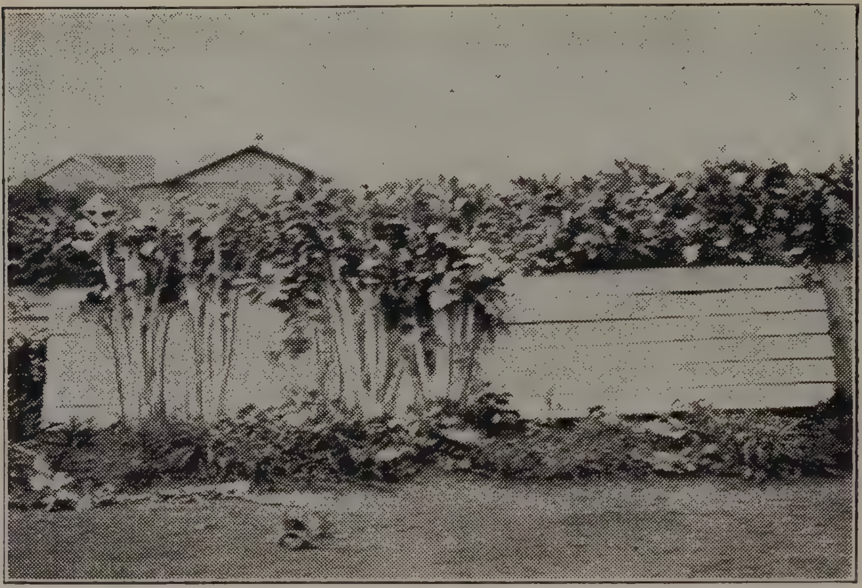

Plate 205.
Stripped heads (left); unstripped on right.
[*Block: S.A. Jour. Ag.*

should be boarded up with a second lot of boards. The third week probably some of the boards removed from the first boarded plants could be used, as after removal of the boards the plants are ready for immediate harvesting.

HARVESTING.

The method of harvesting is to cut the plant off at ground level with a sharp spade or knife where the outer leaf stalks stool out from the plant. The outer ragged leaf stalks are stripped off until the remainder has an attractive appearance. The outer leaves are of poor quality. After stripping, all soil is washed from the plants.

The celery imported from South Australia is usually packed in cases about the size of the local tropical fruit case, i.e., 24$\frac{3}{4}$, x 12 x 12, though the boards are spaced to allow ample ventilation. If provision is made for the latter requirement, the tropical fruit case would serve for local market.

Plate 206.
Carting celery to the packing shed.
[*Block: S.A. Jour. Ag.*

Plate 207.

Field Officers of the Fruit Branch.

Front row (left to right)—Messrs. S. F. Kajewski, M. A. Hannigan, E. L. Miles, E. L. V. Filer, K. King, S. C. Schindler, E. S. Keehn, E. P. Williams, J. R. Horsley.

Seated (left to right)—Messrs. W. C. Armstrong, J. H. Gregory, R. L. Prest, S. E. Stephens, H. Barnes (Director), H. J. Freeman, W. J. Ross, H. St. J. Pratt, H. Collard.

Back row (left to right)—Messrs. H. G. Crofts, F. L. Jardine, A. M. Richardson, E. F. Duffy, C. N. Morgan, K. D. Hoffmann, H. Grimes, P. Mitchell, J. H. Mitchell, J. McG. Wills, W. E. Hamley, C. G. Williams, W. G. Hancock.

VARIETIES.

Varieties recorded by Douglass as suitable for New South Wales conditions and which may be worth trial in this State are:—

Export White—This is the long Adelaide type. It is a non-hearting variety with exceptionally long, clear stems which blanch to a fine golden-cream colour. It is outstandingly disease resistant under Australian conditions.

Golden Self Blanching—An American heart celery from Eastern U.S.A., where it is grown without blanching boards. The heavy outer leaves give enough protection with slight soil hilling to give perfect blanching. This celery is of outstanding quality, but it is rather subject to Chocolate Leaf Spot.

Golden Plume—Very similar to Golden Self Blanching, is reputed to be of French origin. This variety is slightly better quality than the lastmentioned variety and is much stronger in stem.

Utah—A green-stemmed celery of outstanding disease resistance which should do well in this country. The stems are fibrous, medium in length, and have a strong characteristic flavour.

Fruit Marketing Notes.

JAS. H. GREGORY, Instructor in Fruit Packing.

DURING the past month values for most fruits have been maintained. The continued dry weather is, to a great extent, retarding the development of large-sized fruits. Custard apples and strawberries are now coming into season, adding variety to the excellent range of fruits available in Brisbane.

BANANAS.

Bananas have reached high prices on all markets, growers finding it hard to decide which market actually will give the best returns. The dry conditions experienced over the last twelve months have increased the supplies of the smaller grades. Much under-grade fruit is being marketed, very often being used as fillers or peg bananas in the centres of the packed cases. Numerous lines of undersized fruit have been removed from the market. The inclusion of a smaller grade of fruit for local market supplies is now receiving consideration. The inclusion of a smaller grade will necessarily mean the strictest enforcement of the standard, and nothing under the minimum size prescribed will be allowed on the market.

Brisbane prices were—For Cavendish, sixes 10s. 3d. to 14s., sevens 11s. 6d. to 16s., eights and nines 15s. 6d. to 16s. 6d. per tropical case; prices for bunch fruit, Cavendish, ranged from 2½d. to 8½d. per dozen, and Lady's Fingers from 5¾d. to 9d. per dozen.

In Sydney prices ranged for sixes from 14s. to 17s. per tropical case, sevens 17s. to 19s. per tropical case and 7s. to 11s. per bushel case, eights 19s. to 21s. per tropical case and 10s to 12s 6d. per bushel case, and nines 21s. to 23s. per tropical case.

In Melbourne prices for bananas in tropical cases were—sixes 14s. to 16s., sevens 17s. to 18s., eights and nines 19s. to 20s.; and in the bushel case, sixes 10s. to 11s., sevens 11s. 6d. to 12s., and eights 12s. to 13s.

Consignments in bushel cases showed satisfactory results on the Melbourne market, but were very unsatisfactory in Sydney. It is apparent that the wholesale trade on these markets does not show any enthusiasm for suggested improvements to the grower's end of the handling.

PINEAPPLES.

Pineapple values are sound. With the advent of the cool weather closer attention must be paid to maturity of the fruit.

Prices for Smoothleaf pines in Melbourne ranged from 10s. to 15s. per tropical case, in Sydney, from 8s. to 14s., and in Brisbane 5s. to 10s.; loose fruit in Brisbane sold at from 1s. to 6s. per dozen. Ripleys brought from 6s. to 9s. per case, and 2s. to 5s. per dozen.

PAPAWS.

Good quality papaws are scarce, and well-coloured fruit is meeting with a ready demand. Brisbane prices for Yarwun fruit were from 10s. to 12s. per tropical case, for Gunalda fruit 6s. to 7s. per bushel case, and for locals 4s. to 6s. per bushel case. In Sydney prices ranged from 10s. to 12s., while in Melbourne, although up to 20s. per large case has been obtained, prices are now easier at from 14s. to 18s.

CUSTARD APPLES.

Increased supplies of custard apples are now on the market, with a consequent easing of prices. Prices in Brisbane ranged from 3s. to 3s. 6d. per half-bushel, in Melbourne from 3s. to 5s., and in Sydney from 4s. to 5s. Green immature fruit which ripens black is not wanted on any of the Interstate markets.

AVOCADOS.

A steady demand is maintained for avocados on Brisbane and Melbourne markets, with prices ranging from 7s. 6d. to 10s, and from 12s. to 13s. per half-bushel respectively.

CITRUS FRUITS.

Good quality oranges are still in short supply and sell readily, but lemons lack a firm demand.

Oranges.

Brisbane prices for Commons were from 7s. to 9s., for Navels, from 8s. to 11s., and for Benyenda fruit, from 11s. to 14s. per case. In Sydney local Navels sold at from 6s. to 10s.

Mandarins.

Brisbane prices—Glens, Gayndah 10s to 13s., Benyenda 14s. to 16s., local 7s. to 13s., Emperors 6s. to 10s., Scarlets 7s. to 10s., Fewtrells 6s. to 8s. Melbourne prices were from 9s. to 14s. per bushel.

Lemons.

Brisbane prices for Gayndah fruit were from 7s. to 11s., Benyenda 11s. to 14s., and locals 6s. to 9s.; Sydney prices were from 3s. to 9s. per bushel.

Grapefruit.

Brisbane prices were from 6s. to 8s. per bushel, and Melbourne prices from 7s. up to 13s. per bushel for special quality.

Cumquats.

This fruit realised in Brisbane from 4s. to 5s. per half-bushel case.

BERRIES.

Prices for Cape gooseberries were generally from 6d. to 8d. per lb.

Prices for strawberries ranged from 8s. to 18s. per dozen boxes, with special quality berries higher.

DECIDUOUS FRUITS.

Plentiful supplies of apples are arriving from the South. Values are not high although steady returns are being received by growers.

Apples.

Prices were as follows—Granny Smith, Stanthorpe, 6s. to 9s., Southern 6s. to 8s., Jonathan 6s. to 8s., King David 5s., Alfristan 5s., Cleopatra 5s. to 7s., French Crab 5s. to 7s., Sturmer 5s. to 7s.

Pears.

Winter Cole 6s. to 9s., Winter Nelis 7s. to 10s., Packham's 6s. to 8s., Gleau Morceau 6s. to 8s., Josephine 9s. to 10s.

Grapes.

Ohanez and Cornichon sold at from 8s. to 10s. per case.

PASSION FRUIT.

In Brisbane up to 9s. per half-bushel case was obtained for specials, while first grade fruit ranged from 6s. to 7s., and second grade from 4s. to 5s. Sydney prices were from 3s. to 7s. per half-bushel case.

TOMATOES.

Increased supplies have reduced the price considerably during the last month. Growers would be well advised to keep green fruit off the market. Ripe fruit realised from 2s. 6d. to 4s. per half-bushel, coloured fruit from 3s. to 4s. 6d., and green fruit from 2s. to 4s.

VEGETABLES.

Beans sold in Melbourne at from 10s. to 20s. per 50 lb., or from 2½d. to 5d. per lb. In Brisbane, 3s. to 4s. per sugar bag was obtained for choice quality, and 1s 6d. to 2s. 6d. for small and second quality.

Brisbane prices for lettuce were from 6d. to 1s. per dozen.

PUBLICATIONS.

''Banana Packing'' is now available, while pamphlets on passion fruit, strawberry, and peach marketing are in the press. Copies may be obtained free upon application to the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane, B.7.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, and the Guernsey Cattle Society, production charts for which were compiled during the month of April, 1937 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORNS.			
	MATURE COW (OVER 5 YEARS), STANDARD 350 LB.			
Lemon Grove Ruby 7th	J. Phillips, Sunnyview, Wondai	15,501·0	685·607	Dan of Greyleigh
Honey 8th of Sunnyside (365 days)	P. Moore, Wooroolin	15,955·75	647·632	Bruce of Avonel
Rosebud 7th of Oakvilla	W. G. Marquardt, Springlands, Wondai ..	14,859·5	609·409	Victory of Greyleigh
Fussy of Alfa Vale	W. H. Thompson, Alfa Vale, Nanango	14,331·2	537·095	Reward of Fairfield
	JUNIOR, 4 YEARS (UNDER 4½ YEARS), STANDARD 310 LB.			
Alfa Vale Gentle 2nd (365 days)	W. H. Thompson, Nanango	17,369·15	818·088	Reward of Fairfield
	SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.			
Model VI. of Alfa Vale	W. H. Thompson, Alfa Vale, Nanango	11,961·1	490·341	Reward of Fairfield
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
Laura of Alfa Vale	W. H. Thompson, Alfa Vale, Nanango	13,755·7	450·54	Reward of Fairfield
College Buttercup 3rd	Queensland Agricultural High School and College Gatton	9,270·32	391·371	College Robin
Sunnyview Bess II.	C. C. Stumer, Cooranga, Mundubbera	8,226·32	285·164	Burradale, Byron
College Rascal 4th	Queensland Agricultural High School and College, Gatton	6,547·89	277·134	College Robin
	JUNIOR 2 YEARS (UNDER 2½ YEARS), STANDARD 240 LB.			
Trevor Hill Iris	G. Gwynne, Umbiram	6,748·83	263·066	North Glen Emblem

JERSEY.

MATURE COW (OVER 5 YEARS), STANDARD 350 LB.				
Fauvic Rejoice	H. Cochrane, Kin Kin	6,992·65	407·994	Zingara King
Diamond 2nd of Southbrook	H. T. C. Gibson, Kingaroy	6,331·75	369·632	Werribee Twylish Starbright King
SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD 330 LB.				
Glenview Sultane's Majesty	F. P. Fowler and Sons, Coalstoun Lakes	10,344·35	552·569	Trinity Officer
SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.				
Fauvic Gaiety	H. Cochrane, Kin Kin	6,505·35	341·264	Oxford Ringboy
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.				
Brooklands Royal Rosina	W. S. Conochie, Sherwood	9,135·86	417·152	Retford Earl Victor
Oxford Best's Rosina	S. H. Caldwell, Walkers Creek, via Bell	4,334·38	239·949	Oxford Best

GUERNSEY.

SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.				
Lilac Pearl	W. R. Snell, Peeramon	6,817·15	297·653	Spurfield Bruce

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.

Barley Mitchell Grass.

L.D.C. (Brisbane)—

The specimen forwarded from Hughenden represents a form of the barley Mitchell (*Asterbla pectinata*). This particular species of Mitchell shows considerable variation, some forms approaching in appearance the bull Mitchell, this being much smaller. In some parts of Queensland during the past year, the barley Mitchell seems to have come back in many localities; in fact, it has made its appearance in many places where we did not know it existed before.

C.F.P. (Calen)—

We have no records of pandanus being poisonous or harmful to cattle in any way, and it is not known to possess any poisonous properties. Grass trees have been suspected, at different times, of causing the symptoms reported by you, but feeding tests with grass trees in Queensland have always yielded negative results, and the theory has been that it is purely a deficiency disease due to the poorness of the country on which grass trees grow. This idea is supported by the fact that on better class forest country, grass trees have been looked on as quite an important fodder during times of drought.

Wild Tomato or Potato Bush.

A.J.R. (Oorindi)—

The specimen represents the wild tomato or potato bush, *Solanium esuriale*. It has sometimes been suspected of poisoning stock in Queensland, but actual feeding tests in New South Wales gave negative results. We have a number of solanums in Queensland, and, generally, the fruits of solanum—in the green state at any rate—can be regarded as harmful. As the fruits ripen, they usually lose entirely, or for the greater part, their poisonous properties. At Muckadilla, some years ago, this berry was blamed for losses among sheep after some days of heavy rain. Post-mortems showed the stomachs full of berries, but in that case, distinct fermentation had set up, yellow froth being most pronounced.

A plant that is reputed to cause symptoms similar to those you describe is the so-called wild sunflower of the North-west, *Medelia asperrima*. You might have a look for this in your paddocks.

Texas Grass—Guinea Grass.

N.E.B. (Kilcoy)—

The plant with the smooth leaves and pale-coloured seed-head is *Panicum bulbosum*, sometimes called Texas grass. This grass has been grown on a limited scale in New South Wales and Queensland, but is quite rare. As a matter of fact, the only plot we knew in Queensland was one at the Queensland Agricultural College.

The larger grass with hairy leaves and darker-coloured seed-head is a variety of Guinea grass (*Panicum maximum*). Guinea grass is undoubtedly an excellent fodder, but does not stand up to heavy stocking. Several varieties of this grass have been introduced in recent years, and some are said to stand grazing much better than the older types, particularly one known as green panic, and another known as *coloratum*. We think the latter is one of your particular variety.

General Notes

In Memoriam.

The death of Mr. Atkinson Robert Wilkin, which occurred at his home in Brisbane on 4th May, is regretfully recorded.

The late Mr. Wilkin was born at Tilba Tilba, New South Wales, in 1869, and was educated at the Bega (N.S.W.) High School. Twenty-six years ago he came to Queensland from New South Wales to join the staff of the Department of Agriculture and Stock (Dairy Branch) as senior instructor in cheesemaking, a position he held until his recent retirement on reaching the age limit.

He had devoted practically the whole of his career to the dairying industry, possessing an expert knowledge of cheesemaking. He was recognised as a keen judge of dairy produce and was called upon to adjudicate in many competitions throughout the State. His services were requisitioned from time to time in the official grading of Queensland products. His lengthy association and wide experience in cheesemaking enabled him to conduct with much credit the supervision of the manufacture of the largest cheese exported from this State.

The late Mr. Wilkin took a keen interest in cricket and tennis.

He is survived by his widow and six daughters, to whom deep sympathy is extended.

Staff Changes and Appointments.

Constable T. O. Hawkins (Jackson) and Constable C. G. Rattenbury (Nerang) have been appointed also inspectors of slaughter-houses as from the 15th May.

The following persons have been appointed Members of Stallion Boards for the coming year:—

Darling Downs North—J. C. J. Maunder, B.V.Sc. (Chairman), W. C. Jeffrey, and J. H. Salmon.

Darling Downs South—A. F. S. Ohman, M.V.Sc. (Chairman), Gavin Elliot, and J. H. Wall.

East Moreton—J. C. J. Maunder, B.V.Sc. (Chairman), Wm. Frood, and R. J. F. O'Bryen.

West Moreton—A. F. S. Ohman, M.V.Sc. (Chairman), Wm. Frood, and R. J. F. O'Bryen.

Wide Bay—P. F. A. Hardman, B.V.Sc. (Chairman), M. F. Yore, and H. S. Handley.

Burnett—P. F. A. Hardman, B.V.Sc. (Chairman), M. F. Yore, and H. S. Handley.

Central Coast—M. R. Irving, B.V.Sc. (Chairman), T. J. Turkington, and G. H. Stokes.

Northern Coast—M. R. Irving B.V.Sc. (Chairman), David Jackson, and W. A. Coady.

Northern—A. L. Clay, B.V.Sc. (Chairman), Gavin Elliot, and C. F. G. Collins.

Mr. O. L. Hassell, Senior Instructor in Agriculture, has been transferred from Mareeba to Atherton.

The resignation of Mr. R. W. Greville, Assistant Veterinary Surgeon on probation, Townsville, has been accepted as from the 26th June, 1937, and Mr. R. E. Churchward, Government Veterinary Surgeon, Cloncurry, has been transferred to Oonoonba, Townsville, in place of Mr. Greville.

Constables A. R. K. Pearson (Duaringa) and L. X. Skelly (Mount Mulligan) have been appointed also inspectors of slaughter-houses as from the 22nd May, 1937.

Mr. F. A. Williams, of Upper Cedar Creek, Dayboro' Line, has been appointed an honorary ranger under the Animals and Birds Acts as from the 22nd May, 1937.

Rural Topics

Feeding Dairy Cattle in Winter.

Many farmers conserve enough roughage to last their dairy herds through a severe winter, but few understand why the milkers fail to keep up production- Mastication and digestion of dry roughage use up at least 60 per cent. of the energy value of the feed. With concentrates, less than 20 per cent. is used. It follows that very often on poor quality roughage, a cow is either unwilling or unable to consume enough to meet the requirements of full lactation. The trouble might be met in two ways. Extra consumption can be stimulated by increasing the palatability of the food. Molasses thinned out with water is excellent for this purpose. Bran and other milling by-products may also be used when prices are reasonable, but it appears unlikely that, for this year, cereals or their by-products will be able to compete with other concentrates.

Seed cake preparations are excellent for dairy cattle. On account of its slightly laxative nature, linseed has found greatest favour. There is a growing tendency to replace vegetable proteins by animal protein. Meat and animal protein meals are used extensively when analyses and prices are sufficiently attractive. By consulting the registered analyses and comparing costs, the farmer can determine which product is the cheapest to buy. All farmers who have overcome the cow's natural dislike for meat and animal protein meals have been amply repaid by the money saved and by the increased production. Under certain conditions, however, it may be uneconomical to feed such concentrates. This is usually the case with poorer milking herds.

The farmer should add a mineral supplement to the ration of all milkers, as well as heavy-in-calf cows. A mixture of two parts sterilised bone meal and one of salt should be kept in a convenient place, and about one eggcupful mixed in each feed. With heavy milkers, the allowance might be doubled.

The Management of the Bull.

The bull should be kept away from the rest of the herd in a separate run which is securely fenced and provided with water and shelter. A small service yard and a crush to facilitate the handling of the bull when necessary should also be provided.

The advantages gained by keeping the bull away from the herd are:—

1. Calving can be regulated.
2. It is easier to decide whether or not the cow is in calf.
3. The bull's services are controlled and not wasted.
4. There is less likelihood of the cows having to return to the bull.

If the run is not erected alongside a road the annoyance caused by a neighbour's cows breaking into the bull or the bull breaking out is avoided. There is always the danger that other cattle may be suffering from contagious abortion or vaginitis, which are dangerous to the farmer's own herd.

Selection of Cuttings for the Propagation of Grape Vines.

Now is the time, while grape vines are still in leaf, to select and tag those vines from which cuttings are to be taken. Don't leave it to chance in the winter, and merely take the cuttings at random from a row of the variety to be propagated. Select them from vines of outstanding merit which have proved to be consistent croppers of good quality fruit over a number of years, and which have set bunches of even-sized berries, and at the same time have maintained a healthy and vigorous constitution. Avoid the runts or vines which are inconsistent croppers, and any which persist in setting their fruit in an erratic manner.

While the behaviour of the vines in the vineyard is still fresh in their minds, growers should carefully consider their planting programme, and decide which non-commercial vines are to be grafted over with better sorts.

Select varieties suited to the district, and above all don't plant more than a few new or unknown types for observation purposes.

A vineyard should be a valuable asset for many years. Careful selection of both varieties and cuttings can often save considerable expense and time in later years.

Orchard Notes

JULY.

THE COASTAL DISTRICTS.

THE marketing of citrus fruits will continue to occupy the attention of growers. The same care in the handling, grading and packing of the fruit that has been so strongly insisted upon in these monthly notes must be continued if satisfactory returns are to be expected. It is pleasing to note that citrus fruits coming on to the Brisbane market and elswhere show great improvement in grading, packing, and quality as compared with the citrus products of previous years.

Where the crop has been gathered, the trees may be given such winter pruning as may be necessary, such as the removal of broken or diseased limbs or branches, and the pruning of any superfluous wood from the centre of the tree. Where gumming of any kind is seen it should be at once attended to. If at the collar of the tree and attacking the main roots, the earth should be removed from around the trunk and main roots—all diseased wood, bark, and roots should be cut away, and the whole of the exposed parts painted with Bordeaux paste.

When treated, do not fill in the soil around the main roots, but allow them to be exposed to the air for some time, as this tends to check any further gumming. When the gum is on the trunk or main limbs of the tree cut away all diseased bark and wood till a healthy growth is met with, and cover the wounds with Bordeaux paste.

Towards the end of the month all young trees should be carefully examined for the presence of elephant beetles, which, in addition to eating the leaves and young bark, lay their eggs in the fork of the tree. When the young hatch out they eat their way through to the wood and then work between the wood and the bark, eventually ringbarking one or more of the main limbs, or even the trunk. A dressing of strong lime sulphur to the trunk and fork of the tree, if applied before the beetles lay their eggs, will act as a preventive. In the warmer localities a careful watch should also be kept for the first appearance of any sucking bugs, and to destroy any that may be found. If this is done systematically by all growers the damage done by this pest will be very much reduced.

Citrus trees may be planted throughout the month. Take care to see that the work is done in accordance with the instructions given in the June notes. All worn-out trees should be taken out, provided the root system is too far gone to be renovated; but when the root system is still good the top of the tree should be removed till sound, healthy wood is met with, and the portion left should be painted with a strong solution of lime sulphur. If this is done the tree will make a clean, healthy growth in spring.

The inclusion of a wide range of varieties in citrus orchards is to be deprecated. Even in new plantings there is a tendency to follow the same unprofitable lines. Far too much consideration is given to the vendor's description for the purchaser's appreciation of a particular variety or varieties. Individual tastes must be subordinated to market requirements, and the selection of varieties to the best available kind of early, medium, and late fruits. Amongst oranges Joppa should be placed first, Sabina for early fruit, and Valencia for late markets.

In mandarins local conditions influence several varieties, and since the introduction of the fungus known as ''scab'' the inclusion, particularly on volcanic soil, of the Glen Retreat and Emperor types is risky. In alluvial lands, Emperor and Sovereign (an improved Glen Retreat) are the most profitable, though Scarlet in many places is worth including, with King of Siam as a late fruit.

Land intended for bananas and pineapples may be got ready, and existing plantations should be kept in a well-cultivated condition so as to retain moisture in the soil.

Bananas intended for Southern markets may be allowed to become fully developed, but not coloured, as they carry well during the colder months of the year.

The winter crop of smoothleaf pines will commence to ripen towards the end of the month, and when free from blackheart (the result of a cold winter) or from fruitlet core rot, they are good for canning, as they are of firm texture and stand handling. Where there is any danger of frost or even of cold winds, it pays to cover pines and also the bunches of bananas. Bush hay is used for the former and sacking for the latter.

Strawberries should be plentiful during the month, provided the weather is suitable or their development, but if there is an insufficient rainfall, then irrigation is required to produce a crop. Strawberries, like all other fruits, pay well for careful handling, grading, and packing, well-packed boxes always realising a much higher price than indifferently packed ones on the local market.

When custard apples fail to ripen when gathered, try the effect of placing them in the banana-ripening rooms, and they will soon soften instead of turning black.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

JULY is a busy month for the growers of deciduous fruits, as the important work of winter pruning should, if possible, be completed before the end of the month, so as to give plenty of time for spraying and getting the orchard into proper trim before the spring growth starts.

In pruning, follow the advice given in the May number; and if you are not thoroughly conversant with the work, get the advice of one of the Departmental officers stationed in the district.

Pruning is one of the most important orchard operations, as the following and succeeding seasons' crops depend very largely on the manner in which it is carried out. It regulates the growth as well as the number and size of the fruit, as if too much bearing wood is left there is a chance of the tree setting many more fruits than it can properly mature, with a result that unless it is rigorously thinned out it is under-sized and unsaleable. On the other hand, it is not advisable to unduly reduce the quantity of bearing wood, or a small crop of overgrown fruit may be the result.

Apples, pears, and European varieties of plums produce their fruits on spurs that are formed on wood of two years' growth or more; apricots and Japanese plums on new growth and on spurs; but peaches and nectarines always on wood of the previous season's growth. Once peachwood has fruited it will not produce any more from the same season's wood, though it may develop spurs having a new growth or new laterals which will produce fruit.

The pruning of the peaches and nectarines, therefore, necessitates the leaving of sufficient new wood on the tree each season to carry a full crop, as well as the leaving of buds from which to grow new wood for the succeeding year's crop. In other words, one not only prunes for the immediately succeeding crop, but also for that of the following season.

All prunings should be gathered and burnt, as any disease that may be on the wood is thoroughly destroyed. When pruned, the trees are ready for their winter spraying.

All kinds of deciduous trees may be planted during the month provided the ground is in proper state to plant them. If not, it is better to delay planting until August, and carry out the necessary work in the interval. The preparation of new land for planting may be continued, although it is somewhat late in the season, as new land is always the better for being given a chance to mellow and sweeten before being planted. Do not prune vines yet on the Granite Belt; they can, however, be pruned on the Downs and in the western districts.

Trees of all kinds, including citrus, can also be planted in suitable situations on the Downs and western districts, and the pruning of deciduous trees should be concluded there. If the winter has been very dry, and the soil is badly in need of moisture, all orchards in the western districts, after being pruned and ploughed, should receive a thorough irrigation (where water is available) about the end of the month, so as to provide moisture for the use of the trees when they start growth. Irrigation should be followed by a thorough cultivation of the land to conserve the water so applied. As frequently mentioned in these notes, irrigation and cultivation must go hand in hand if the best results are to be obtained, especially in our hot and dry districts.

VEALER CALVES.

Provided a calf is kept on the mother to allow it to reach a live weight of about 80 lb., a satisfactory return is assured when marketed. Large numbers of calves are being slaughtered annually for export as boneless veal, and the trade has reached such proportions that buyers are usually operating in all dairying districts. Even if the mother is to be dried off early, it is well worth while to keep the calf for a few days before selling for slaughter. A calf responds quickly to a few days suckling, and this can quite easily mean the difference between an underweight and overweight calf—a matter of at least 5s. in its value.

Farm Notes

JULY.

FIELD.—Practically the whole of the work on the land for this month will be confined to the cultivation of winter crops, which should be now making good growth, and to the preparation of land for the large variety of crops which can be sown next month. Early maturing varieties of wheat may be sown during the month Florence, Seaspray, and Novo all being suitable. When seasonal rains are delayed, and the main sowing is not effected until July, the medium early varieties, such as Three Seas, Flora, Pusa, and Clarendon, may also be sown with every prospect of success, but during normal seasons it is preferable to sow such varieties prior to July. Sow late maturing varieties early and early maturing varieties late. The harvesting of late-sown maize will be nearing completion, and all old stalks should be ploughed in and allowed to rot. Clean up all headlands of weeds and rubbish, and for this purpose nothing equals a good fire. Mangels, swedes, and other root crops should be now well away, and should be ready for thinning out. Frosts, which can be expected almost for a certainty this month, will do much towards ridding the land of insect pests and checking weed growth. Cotton-picking should be now practically finished and the land under preparation for the next crop. The young lucerne should be becoming well established; the first cutting should be effected before the young plants reach the flowering stage, as although such an early mowing is seldom worth gathering, it has the effect of stimulating root growth, to the benefit of subsequent cuttings, which are usually made when approximately one-third of the plants have reached the flowering stage. If weed growth is prevalent during the spring months, frequent cutting is often necessary as a control to prevent seeding.

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QUEENSLAND SHOW DATES FOR 1937.

June.

Bundaberg	3rd to 5th
Biloela	3rd to 5th
Lowood	4th and 5th
Boonah	9th and 10th
Gladstone Jubilee Show	10th and 11th
Marburg	18th and 19th
Rockhampton	22nd to 26th
Mackay	29th June to 1st July

July.

Kilcoy	1st and 2nd
Proserpine	2nd and 3rd
Bowen	7th and 8th
Ayr	9th and 10th
Rosewood	9th and 10th
Pine Rivers	9th and 10th
Cleveland	9th and 10th
Townsville	13th to 15th
Nambour—	
Show	15th and 16th
Campdraft	17th
Esk	16th and 17th
Charters Towers	20th to 22nd
Laidley	21st and 22nd
Maleny	22nd and 23rd
Cairns	27th to 29th
Gatton	28th and 29th
Barcaldine	28th and 29th
Emerald	28th and 29th
Caboolture	30th and 31st

August.

Crow's Nest	4th and 5th
Home Hill	6th and 7th
Royal National, Brisbane	16th to 21st
Wynnum	27th and 28th

September.

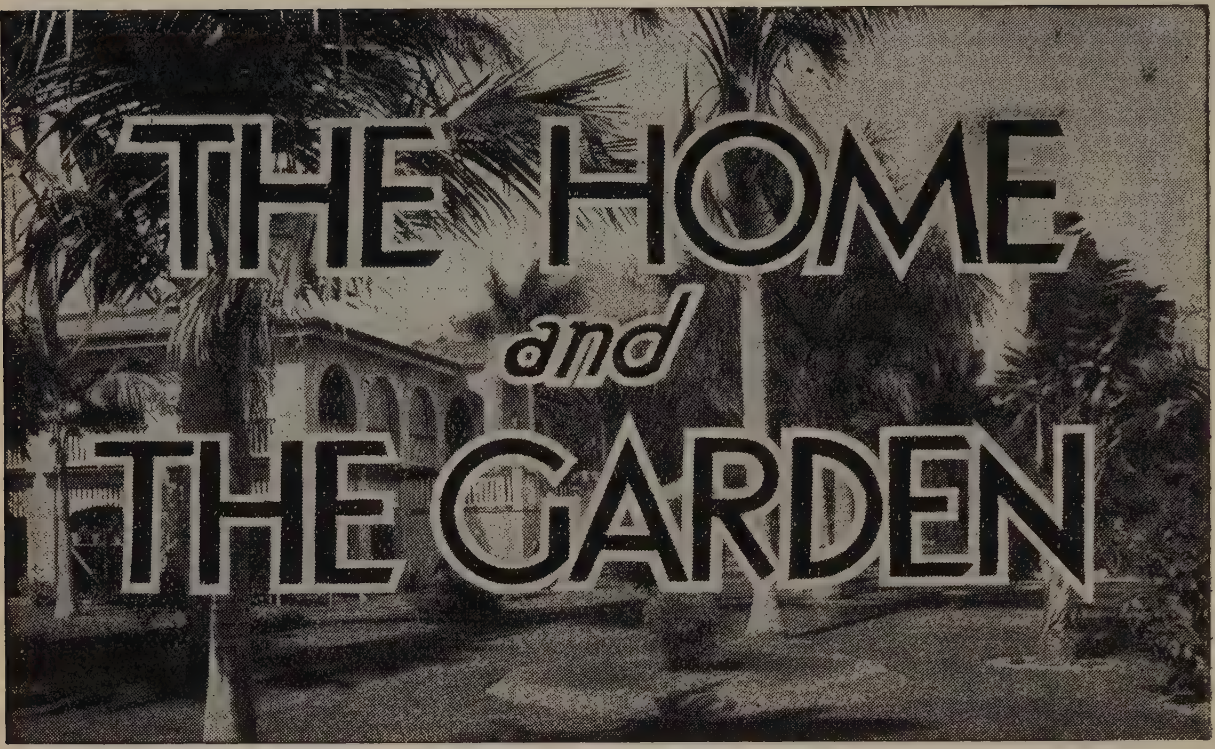
Imbil	3rd and 4th
Ingham	3rd and 4th
Pomona	10th and 11th
Tully	10th and 11th
Rocklea	11th
Innisfail	17th and 18th
Malanda	22nd and 23rd

October.

Ravenshoe	8th and 9th
Millaa Millaa	1st and 2nd

November.

Murwillumbah	3rd and 4th



OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

WINTER DANGERS.

COUGHS and colds and sore throats occur all the year, but are more common in winter. At this season also they are more serious and more often followed by bronchitis and pneumonia, which are formidable diseases, and may cause death even in the robust, but much more often in those who are weakly from poor nutrition or from any other cause. It must be remembered that any sore throat in a child may be the commencement of an attack of diphtheria, which also prevails most often in the colder months. Therefore, although the great majority of these attacks are mild or even trivial occurrences, many of them are dangerous, and the mortality that they cause is not inconsiderable. This is true, not only in countries that experience severe cold, but even in Queensland, whose mild winter season should be the healthiest time of the year.

It is most important that all mothers should clearly understand that all these diseases, including the ''common cold,'' are caused by disease germs, that spread from one person to another. They are spread chiefly by those suffering from mild attacks, or who have recently recovered from an attack, but are not yet free from the infectious germs, and even by those who appear perfectly well, but are carrying these germs in their throats and noses. Whenever these persons cough, and even during speaking, these germs are thrown out in a fine, invisible spray, which floats around them, and so easily enter other peoples' throats or noses. Another method of spread is due to the bad habit, unfortunately so common in children, of putting their fingers in their mouths or to their noses, and smearing the secretions containing the germs on to other children's hands and faces. Babies should be protected from those who wish to kiss them.

It is easy to understand why these diseases are more common in winter, for in that season people are most crowded together in rooms often very poorly ventilated. The greatest risks are run in crowded halls, where there are sure to be some carriers of these diseases when they are prevalent. In schools also epidemics occur, and are not always avoidable, but children before school age, and especially babies, should never be exposed to unnecessary risks by taking them to picture-shows and such like. Exposure to cold by itself can never cause these troubles, though it may temporarily lower the resistance of those who may happen to be carrying the germs in their throats. In young children these diseases are almost invariably contracted from another person. Fatigue may also temporarily lower the resistance, and this is an additional reason for keeping young children at home in the evenings, and giving them a good night's rest.

The mother's great aim should be not only to protect her children from infection, but to increase their resistance. For this good nutrition is of the greatest importance, giving plenty of the protective foods—milk, butter, eggs, vegetables, fruit, wheatmeal, or cerevite, and in the case of weakly children cod liver oil in some form. All rooms should be well ventilated. The best sleeping places are rooms with windows wide open or verandas so long as the children are well covered and sheltered from cold winds. From diphtheria they may be protected by inoculation.

When the child is suffering from a cold or cough, unless very trivial, he should be kept in bed. This is imperative if the thermometer shows a rise of temperature. Compared with this all treatment by medicines is of comparatively small importance.

IN THE FARM KITCHEN.

STEWS, WHITE AND BROWN.

THERE are two kinds of stews—a white stew, such as Irish stew, which has a thin white gravy, or a brown stew, which has a thick brown gravy. A brown stew can be cooked on top of the stove or in the oven, whichever place is most convenient.

Stewed Steak and Dumplings.

Take 2 lb. stewing steak, flour, pepper, salt, and water.

For the dumplings, take ½ lb. flour, ¼ lb. suet, 1 small teaspoonful baking powder. water to mix. Wipe the steak and cut into six or eight pieces. Flour them well and season with pepper and salt, then put them into a casserole and cover with water. Put the casserole into the oven, bring to the boil, skim it if required, then let it simmer gently for about three hours. To make the dumplings, chop the suet finely and mix it with the flour (to which the baking powder has been added). Add cold water and mix to a stiff paste, then divide it into portions and make into dumplings. Add these to the stew when it is half-cooked, allowing them about one hour and a half. Serve the stew on a hot dish with the dumplings round.

Exeter Stew.

Take 1½ lb. stewing beef, 2 oz. dripping, 2 carrots, turnip (if liked), 1 tablespoonful vinegar, 3 onions, 1 tablespoonful flour, salt and pepper, dumplings.

Cut the meat into neat cubes and fry in hot fat for five minutes. When brown all over, remove the meat to a plate, then brown the sliced onions slightly, in the fat. Stir in the flour and season to taste and thin down with stock or water. When the mixture is boiling, return the meat to the saucepan, add the sliced carrots and turnip, cover, and simmer for two hours. Add six or eight dumplings and cook another half-hour. Serve the meat and vegetables on a very hot dish garnished with the dumplings.

Haricot Mutton.

Take 2 lb. neck of mutton, 2 carrots, 6 small turnips, 2 oz. butter (or dripping), 1 dessertspoonful flour, a little parsley, thyme, bayleaf, 1 small clove or garlic, ½ pint boiling water, salt, and pepper.

Divide the mutton into cutlets, and, if very fat, remove some of it. Heat about half of the butter or dripping in a stewpan, fry the meat quickly until the entire surface is lightly browned; sprinkle it with flour, so as to make it brown more quickly. When ready, add the boiling water, garlic, a little salt and pepper, and the parsley, thyme, and bayleaf. Cover with a close-fitting lid, and cook very slowly for one hour. In the meantime heat the remaining butter, peel the turnips, cut into thick slices, and fry them brown, then drain them and put into stewpan containing meat, also the carrots previously scraped and cut into neat pieces. Continue to cook slowly until both meat and turnips are tender, then pile the meat in the centre of a hot dish and arrange the pieces of turnip round the base. Skim well to remove some of the fat, then strain the gravy over the meat and serve.

Irish Stew.

Take 1½ lb. scrag and middle neck mutton, ½ lb. onions, 1 lb. potatoes, water, pepper, and salt.

Wipe the meat and divide into portions. Peel and slice the onions. Put them into a large saucepan with the meat, add a little pepper and salt and just sufficient water to cover it. Bring it to the boil and remove the scum from the top, then leave the stew to simmer gently for from one and a-half to two hours, keeping it skimmed as required. Peel the potatoes, wash, split into halves, and cut them across again if they are large. Place these on top of the stew (when the latter is about half-cooked) and sprinkle them with salt. When the meat is ready the potatoes should be soft. To serve the stew, place the meat and onions in the centre of a very hot dish and the potatoes round the edge to form a border. Pour some gravy round, making quite sure first that it is free from grease.

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WHEAT VARIETIES.

The census of wheat varieties sown in Queensland during the 1936-37 season, compiled by the Queensland State Wheat Board, Toowoomba, disclosed the fact that Florence still maintains its position as the most popular variety with an area of 71,903 acres, representing 20·5 per cent. of the total acreage sown. This wheat has been popular for many years on account of its ability to yield well over a wide range of soils and climatic conditions. If seasonally sown, it will usually escape rust. Its chief defect is a tendency for the grain to scatter in the field when ripe, rendering it susceptible to storm damage.

Flora, a short-stemmed grain wheat of high quality, maintains its position with 41,160 acres. In this connection, it is interesting to note that Puora—a Pusa-Flora crossbred recently introduced by the Department of Agriculture and Stock—secured the championship at the recent Sydney Royal Show in the medium strong class.

The varieties Pusa, Three Seas, Gluyas, Cedric, and Seafoam are all represented by areas in excess of 18,000 acres, ranging from 10·8 per cent. of the total area in the case of Pusa, to 5·2 per cent. in regard to Seafoam.

The high proportion of superior hard milling wheats grown in Queensland—such as Florence, Flora, Pusa, Cedric, Ford, and Novo—is an interesting factor in the local wheat industry. Flora, Cedric, Novo, Seafoam, and Three Seas were all bred at the Roma State Farm, and introduced into general cultivation by the Department of Agriculture and Stock through the medium of trial plots established throughout the Darling Downs wheat areas.

—*H. W. Ball.*

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF APRIL IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1937 AND 1936, FOR COMPARISON.

Divisions and Stations.	AVERAGE RAINFALL.		TOTAL RAINFALL.	
	Apr.	No. of Years' Records.	Apr. 1937.	Apr. 1936.
North Coast.	In.		In.	In.
Atherton	4·32	36	1·63	4·55
Cairns	11·36	55	6·57	9·15
Cardwell	8·87	65	0·76	11·06
Cooktown ..	8·88	61	2·01	18·66
Herberton ..	3·84	51	0·35	2·67
Ingham	7·64	45	0·59	7·02
Innisfail	20·09	56	12·47	19·10
Mossman Mill ..	8·29	24	..	5·54
Townsville ..	3·38	66	0·15	2·04
Central Coast.				
Ayr	2·49	50	0·60	2·52
Bowen	2·69	66	1·21	0·26
Charters Towers ..	1·51	55	0·03	1·70
Mackay	6·18	66	1·02	0·65
Prosperine ..	5·80	34	1·22	2·04
St. Lawrence ..	2·76	66	3·04	Nil
South Coast.				
Biggenden ..	2·19	38	0·58	0·84
Bundaberg ..	3·32	54	0·60	0·93
Brisbane	3·81	85	0·92	0·21
Caboolture ..	4·57	50	1·45	0·58
Childers	2·88	42	0·28	1·20
Crohamhurst ..	6·81	44	..	2·64
Esk	3·04	50	1·31	0·31
Gayndah	1·46	66	0·47	0·25
Gympie	3·50	67	0·54	1·14
Kilkivan	2·29	58	0·80	0·18
Maryborough ..	3·88	66	3·03	1·42
Nambour	6·32	41	1·97	2 66
Nanango	1·98	55	0·27	0·32
Rockhampton ..	2·55	66	1·58	0·20
Woodford	4·70	50	1·83	0·64
Central Highlands.	In.		In.	In.
Clermont ..	1·59	66	0·94	Nil
Gindie	1·15	38	..	Nil
Springsure ..	1·54	68	0·51	Nil
Darling Downs.				
Dalby	1·40	67	0·93	0·13
Emu Vale ..	1·41	41	0·57	0·42
Hermitage ..	1·43	31	..	0·16
Jimbour ..	1·39	49	0·78	0·05
Miles	1·46	52	0·77	0·26
Stanthorpe ..	1·78	64	1·44	0·64
Toowoomba ..	2·65	65	0·85	0·68
Warwick ..	1·66	72	0·31	0·47
Maranoa.				
Roma	1·30	63	0·32	0·02
State Farms, &c.				
Bungeworgorai ..	1·20	22	..	Nil
Gatton College ..	1·92	38	..	0·34
Kairi	4·31	21	..	..
Mackay Sugar Experiment Station	4·72	40	..	0·21

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—APRIL, 1937.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Mean Atmospheric Pressure at 9 a.m.	SHADE TEMPERATURE.						RAINFALL.	
		Means.		Extremes.					
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·89	82	72	86	24	62	20	212	5
Herberton	..	77	56	82	19	47	19	35	6
Rockhampton	29·98	84	61	87	7, 16	53	22, 25	158	3
Brisbane	30·02	79	59	85	8	54	22	92	7
Darling Downs.									
Dalby	30·01	77	48	85	1	39	25	88	3
Stanthorpe	..	70	43	80	1	32	22	144	10
Toowoomba	..	72	50	78	1, 8	44	9, 16, 20, 24	86	7
Mid-Interior.									
Georgetown	29·91	88	60	91	23	49	24	49	1
Longreach	29·98	86	55	92	27	49	21	Nil	..
Mitchell	30·03	78	45	84	1	36	21, 25	15	1
Western									
Burketown	29·91	92	65	95	2, 3, 4	58	18, 19	Nil	..
Boulia	30·02	87	60	94	25	52	21	Nil	..
Thargomindah	30·02	80	56	87	2, 3	46	25	Nil	..

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

					MOONRISE.	
	June. 1937.		July. 1937.		June. 1937.	July. 1937.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	a.m.
1	6.37	5·2	6.45	5·7	11·11	12·1
2	6·37	5·2	6·45	5·7	—	—
					a.m.	
3	6·38	5·2	6·45	5·7	12·10	1.3
4	6·38	5·2	6·45	5·8	1·9	2·7
5	6·39	5·2	6·45	5·8	2·11	3·13
6	6·39	5·2	6·45	5·8	3·18	4·21
7	6·39	5·2	6·45	5·9	4·25	5·25
8	6·40	5·2	6·45	5·9	5·35	6·23
9	6·40	5·3	6·44	5·9	6·39	7·13
10	6·40	5·3	6·44	5·10	7·42	7·58
11	6·41	5·3	6·44	5·10	8·36	8·38
12	6·41	5·3	6·44	5·11	9·23	9·15
13	6·41	5·3	6·43	5·11	10.6	9.47
14	6·42	5·3	6·43	5·12	10·44	10·25
15	6·42	5·3	6·43	5·12	11·25	10·58
16	6·42	5·3	6·43	5·13	11·51	11·32
					p.m.	p.m.
17	6·43	5·4	6·42	5.13	12.25	12·12
18	6·43	5·4	6·42	5·14	1·0	12·52
19	6·43	5·4	6·42	5·14	1·35	1·36
20	6·43	5·4	6·41	5·15	2·14	2·24
21	6·44	5·4	6 41	5·15	2·54	3·15
22	6·44	5·4	9·41	5·16	3·40	4·7
23	6·44	5·4	6·40	5·16	4·29	5·7
24	6·44	5·4	6·40	5·17	5·23	6 3
25	6·44	5·5	6·39	5·17	6·18	7·0
26	6·45	5·5	6·39	5·18	7·13	7·58
27	6·45	5·5	6·38	5·18	8.9	8 56
28	6·45	5·5	6.38	5·19	9·6	9·55
29	6·45	5·5	6·37	5·19	10·4	10·56
30	6·45	5·5	6·36	5·20	11·1	11·58
31			6·35	5·21		

Phases of the Moon, Occultations, &c.

2 June	☽	Last Quarter	3 24 a.m.
9 ,,	●	New Moon	6 43 a.m.
16 ,,	☾	First Quarter	5 3 a.m.
24 ,,	○	Full Moon	9 0 a.m.

On 9th June, at 6.40 a.m., the New Moon will arrive at that part of its orbit where it will be in a direct line between the Sun and Earth. Being nearest the Earth, our satellite will apparently be of the same size as the Sun; its cone-shaped shadow will entirely obscure the face of our great luminary and a total eclipse will occur within a limited area—a rare occurrence, because the Moon can wander as much as 5 deg. north or southward from the ecliptic, the apparent path of the Sun—for any one part of the Earth a very rare spectacle indeed. Unfortunately this marvellous phenomenon will not be seen in Australia, but all but our next-door neighbours in the Solomon Islands will see a partial eclipse. Further eastward the path of totality will cross the Pacific Ocean through some of the Ellice and Phœnix Islands and through Fanning and Christmas Islands, ending at the western coast of South America, near Lima in Peru A partial eclipse will be seen in the southern part of North America, Mexico, and the central part of South America from north to south. The duration of the total phase varies for different places—in this case from 3 min. 54 sec. to 7 min. 4 sec. Its path may be 150 miles wide and, incidentally, Fanning and Christmas Islands, opposite each other, lie directly on its border lines.

On the 21st June the Australian winter solstice will occur, when the Sun, having reached its greatest northern latitude, will seem to be stationary, after which it will begin to turn southward.

Venus on the 27th will attain its greatest distance west of the Sun, rising about three hours and a-half before it.

Mars, which since 14th April has been moving with retrograde motion from Scorpio into Libra, will, on the 27th, resume its normal eastward course.

Mercury rises at 4.51 a.m., 1 hour 46 minutes before the Sun, and sets at 3.50 p.m., 1 hour 12 minutes before it, on the 1st; on the 15th it rises at 4.56 a.m., 1 hour 46 minutes before the Sun and sets at 3.45 p.m., 1 hour 18 minutes before it.

Venus rises at 3,21 a.m., 3 hours 6 minutes before the Sun, and sets at 2.42 p.m., 2 hours 20 minutes before it, on the 1st; on the 15th it rises at 3.13 a.m., 3 hours 29 minutes before the Sun, and sets at 2.24 p.m., 2 hours 39 minutes before it.

Mars rises at 3.58 p.m. and sets at 5.23 a.m. on the 1st; on the 15th it rises at 2.48 p.m. and sets at 4.13 a.m.

1st July	☽	Last Quarter	11 3 p.m.
8th ,,	●	New Moon	2 13 p.m.
15th ,,	☾	First Quarter	7 36 p.m.
23rd ,,	○	Full Moon	10 46 p.m.

Perigee, 6th July, at 7 p.m.
Apogee, 18th July, at 8 p.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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